Appendix L

US Forest Service Wildlife Specialist Report

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WILDLIFE SPECIALIST REPORT

I. INTRODUCTION

This wildlife specialist report was developed as the basis of the effects analysis for conservation priority species identified by the U.S. Forest Service and the U.S. Fish and Wildlife Service. This report provides a preliminary look at the effects of adding conservation direction for the conservation of greater sage-grouse and their habitats on the Routt National Forest (RNF).

This analysis is framed around three primary sections:

1. Threatened, Endangered, Proposed and Candidate Species
2. Region 2 species designated by the Regional Forester as 'Sensitive Species' including greater sage-grouse
3. Management Indicator Species

A Biological Assessment (BA) and Biological Evaluation (BE) are not included with this DEIS. However a BA and BE will be prepared and included with the FEIS. This report provides a framework and preliminary analysis of the anticipated effects to these conservation priority species occurring on the RNF. The information included in the section on Threatened, Endangered Proposed and Candidate species will be utilized to develop the BA and the section on 'Sensitive' species will be used to develop the BE for the FEIS.

The management indicator species section of this report describes the anticipated effects of the action alternatives to species identified as Management Indicator Species (MIS). The Forest Service Manual defines MIS as "…plant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (USDA Forest Service 1991).

II. PROJECT HISTORY

Greater sage-grouse (GRSG) have emerged as a significant conservation concern over the last 10 years. The species is currently a candidate species for listing under the Endangered Species Act inferring that listing is "warranted, but precluded due to higher priorities" because of two primary factors: 1) the large-scale loss and fragmentation of habitats across the species range, and 2) a lack of regulatory mechanisms in place to ensure the conservation of the species. The primary threats to sage-grouse habitat are summarized in the listing decision. The two dominant threats are related to infrastructure associated with energy development in the eastern portion of the species range, and the conversion of sagebrush communities to annual grasslands resulting in large uncharacteristic wildfires in the western portion of the species range.

The Bureau of Land Management (BLM) manages approximately half of the remaining occupied greater sage-grouse habitats, whereas the Forest Service (FS) manages approximately 8 percent of species habitat, with most of that occurring on national forests in the Intermountain Region. The Forest Service manages approximately 9 million acres of sage-brush habitats, of which about 7.5 million acres occur in the Intermountain Region. Most habitats on FS administered lands contribute to summer brood-rearing, although some forests and grasslands do contribute important breeding, nesting and winter habitat.

In 2011 and 2012, the United States Fish and Wildlife Service (FWS) submitted letters to the BLM and FS recommending that the agencies amend Land Management Plans (LMP's) to provide adequate regulatory mechanisms in the form of management direction specific to conserve the species. Originally, this recommendation identified 10 National Forests viewed as "high priority" to ensure appropriate regulatory mechanisms. Following scoping and discussion the FS added an additional 10 Forest Plans that would be considered for amendment. The FS is participating in several joint Environmental Impact Statements (EISs) with the BLM to develop Records of Decision that will be used as a basis for amending LMP's, including Forest Plans(http://fsweb.r4.fs.fed.us/unit/nr/sagegrouse/index.shtml, Accessed December 19, 2012).

Because most occupied GRSG habitat remaining on federal lands is managed by the BLM, that agency is leading the effort to amend or revise LMP's, with the Forest Service as a cooperating agency. The purpose is to provide direction in land management plans that conserve and protect sage-grouse habitat and to provide assurances to the USFWS that adequate regulatory mechanisms are in place to ensure the conservation of the species. EISs will be completed for seven sage-grouse planning subregions: 1) eastern Montana and portions of North and South Dakota, 2) Idaho and southwest Montana, 3) Oregon, 4) Wyoming, 5) northwest Colorado, 6) Utah, and 7) Nevada and northern California. The FS is participating in six of these EISs (excluding Eastern Montana/Dakotas and some of the areas in Wyoming). The EISs will include joint agency signatures, but separate Records of Decision."

III. PURPOSE AND NEED

The purpose of the RNF Land and Resource Management Plan amendment for the GRSG is to identify and incorporate appropriate measures to conserve, enhance, and/or restore sage-grouse habitat by reducing, eliminating, or minimizing threats to their habitat. The need to create this amendment arose when the inadequacy of regulatory mechanisms was identified as a significant threat in the USFWS finding on the petition to list the GRSG. The USFWS identified conservation measures within Forest Service Land and Resource Management Plans (as well as BLM LMP's) as the principal regulatory mechanisms for habitat conservation. Therefore, the RNF Land and Resource Management Plan amendment will focus on areas affected by threats to sage-grouse habitat identified by the USFWS in the March 2010 listing decision (USFWS 2010).

IV. DESCRIPTION OF THE ALTERNATIVES

The BLM and Forest Service developed a range of alternatives that are specifically structured to identify and incorporate appropriate conservation measures in LMP's to conserve, enhance or restore GRSG habitat by reducing, eliminating, or minimizing threats to that habitat. There are currently four alternatives to consider under this analysis. A brief description of each of the alternatives is provided below. For a full description of the alternatives please refer to chapter 2 of the DEIS.

Designated sage-grouse habitat is broken down into four categories: Preliminary priority habitat (PPH), preliminary general habitat (PGH), linkage areas, and all designated habitat (ADH). PPH is defined as areas that have been identified as having the highest conservation value to maintaining sustainable GRSG populations. These areas include breeding, late brood-rearing and winter concentration areas. PGH is defined as areas of occupied seasonal or year-round habitat outside of PPH. A third category of linkage areas is also present. Within the document,

all designated habitat (ADH) refers to all PPH, PGH, and linkage areas. PPH, PGH, and linkage areas were developed by Colorado Parks and Wildlife and are described in additional detail within the DEIS.

Alternative A: No-action

Under the no-action alternative the RNF Land and Resource Management Plan would not be amended. The existing management direction for species conservation would continue to guide Forest Plan implementation.

Alternative B

Conservation measures developed by the National Technical Team's (NTT) and summarized in the 2011 Sage-grouse National Technical Team report are the foundation for Alternative B. These conservation measures would apply only to GRSG PPH. There would be a 3% cap on disturbance in these areas. Additional details about this alternative include: Travel construction would be limited in PPH, minimum standards would be applied and there would be no upgrading of roads. Recreation special use permits in PPH would only be allowed if they are deemed to have no effect to the GRSG. Rights-of-way would be excluded in PPH. The RNF would aim to keep and acquire PPH. Grazing direction would be adjusted to improve management for GRSG. PPH would be closed to new fluid minerals leases; existing leases would have a 4-mile no surface occupancy buffer around leks. Wildfire/Fuels would aim to protect sagebrush habitats in PPH. Habitat restoration would be a priority, with a focus on native species.

Alternative C

This alternative would expand many of the conservation measures in alternative B to all designated GRSG habitat, including PPH, PGH and linkage areas. There would be a 3% cap on disturbance in these areas. PPH would be closed to livestock grazing. Additional details about this alternative include: Travel construction would be limited in all designated habitat, and no new roads would be constructed within 4 miles of a lek or occupied habitat. Recreation would seasonally prohibit camping and non-motorized recreation within 4 miles of a lek. All designated habitat would be exclusion areas for rights-of-way and special use permits. The RNF would aim to keep and acquire all designated habitat. Wind and solar installations would not be allowed to be sited in designated habitat. All designated habitat would be closed to new fluid minerals leases; existing leases would have a 4-mile no surface occupancy buffer around leks. Wildfire/Fuels would aim to protect and restore sagebrush habitats; areas would be closed to grazing after wildfire. All PPH would be designated as Zoological Areas on the RNF, a status similar to areas of critical environmental concern on BLM lands.

Alternative D

This alternative is very similar to the NTT alternative. It would be applied to sagebrush ecological sites within PPH. There would be a 5% cap on disturbance in these areas. Additional details about this alternative include: Travel construction would be limited in PPH with a disturbance exception allowing the RNF to exceed the 5% cap if GRSG populations are doing well. Recreation special use permits that do not adversely affect the GRSG would be allowed. Rights-of-way would be excluded in PPH, with the exception of transmission lines. Grazing direction would be adjusted to improvement management for sage-grouse in ADH. PPH would be designated as a no surface occupancy for new fluid minerals leases; existing leases would have seasonal conditional surface use. Wildfire/Fuels would aim to protect sagebrush habitats in ADH. Habitat restoration would be a priority, with a focus on native species.

V. ANALYSIS AREA

Within the analysis area, the management direction proposed in the action alternatives would apply to designated GRSG habitats (PPH, PGH & linkage areas) in northwestern Colorado that have been identified as grouse habitat (Figure 1). However, there are no areas designed as linkage areas on the RNF. This consists of 12,501 total acres of identified GRSG habitat, approximately 1% of the RNF. Of the 12,501 acres of identified habitat on the RNF, 1,571 acres are PPH (13%), and 10,930 acres are PGH (87%). Each of the three Ranger Districts on the Forest contain GRSG habitat. The Hahns Peak/Bears Ears District contains 9,982 acres, the Yampa District contains 1,262 acres, and the Parks District contains1,257 acres (Table 1). Yampa and Parks Districts are the only Ranger Districts with identified PPH, whereas, the Hahns Peak/Bears Ears District contains the majority of the habitat but it is all classified as PGH (Table 1). State and private land inholdings also occur within the National Forest boundary and include sage-grouse habitat as described in Table 1. The breakdown of vegetation cover types on the RNF by GRSG Colorado management zone are described in Table 2.

Table 1. Greater Sage-Grouse habitat by Ranger District and habitat type on the RNF.

Ranger District	Surface land ownership	Greater Sage-Grouse habitat type	Acres
Hahns Peak-Bears Ears	National Forest System	PGH	9,982
Hahns Peak-Bears Ears	Private Inholding	PGH	1,150
Hahns Peak-Bears Ears	State Inholding	PGH	649
		HPBE Total	**11,781**
Parks	National Forest System	PGH	285
Parks	National Forest System	PPH	972
		Parks Total	**1,257**
Yampa	National Forest System	PGH	663
Yampa	National Forest System	PPH	599
Yampa	Private Inholding	PGH	1,179
Yampa	Private Inholding	PPH	1,363
Yampa	State Inholding	PGH	507
Yampa	State Inholding	PPH	6
		Yampa Total	**4,316**
		Grand Total	**17,354**

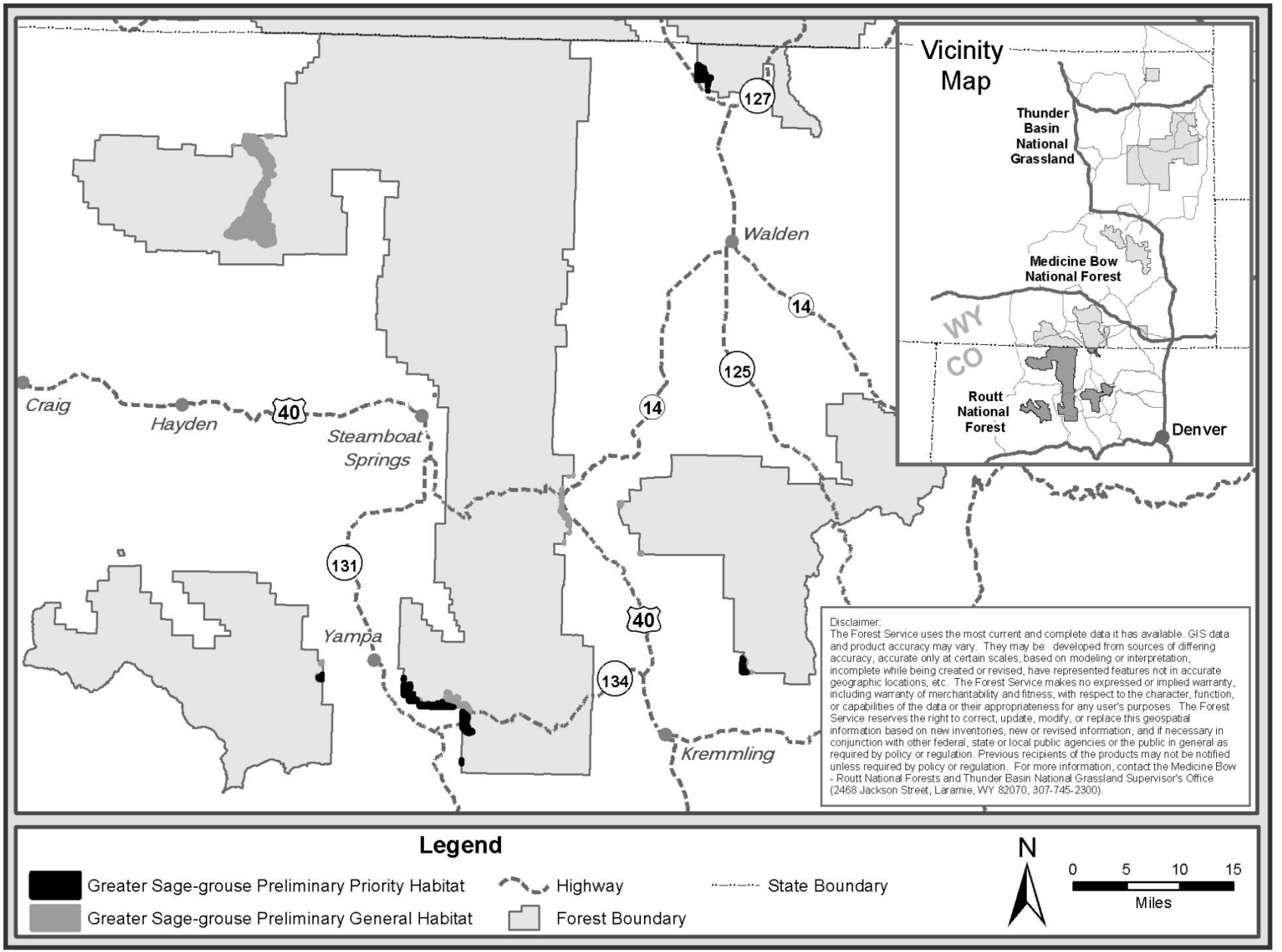

Figure 1.Locations of Preliminary Greater Sage-Grouse habitat on the RNF.

Table 2. Greater Sage-Grouse designated habitat by cover type for each management zone.

Greater Sage-Grouse Management Zone	Greater Sage-Grouse Habitat type	Vegetation Cover type Source: FSveg database	Acres
Zone 07	PGH	Forb, Grass, Sagebrush	7,969
Zone 07	PGH	Grass – Riparian	190
Zone 07	PGH	Shrub	56
Zone 07	PGH	Shrub – Willow	625
Zone 07	PGH	Tree – Aspen	1,011
Zone 07	PGH	Tree - Lodgepole Pine	21
Zone 07	PGH	Tree – Spruce-Fir	58
		Zone 07 Total	**9,930**
Zone 11	PPH	Forb, Grass, Sagebrush	681
Zone 11	PPH	Grass – Riparian	41
Zone 11	PPH	Shrub	22
Zone 11	PPH	Shrub – Willow	2
Zone 11	PPH	Tree – Aspen	6
Zone 11	PPH	Tree – Douglas-Fir	14
		Zone 11 Total	**766**
Zone 13	PGH	Forb, Grass, Sagebrush	533
Zone 13	PGH	Shrub	58
Zone 13	PGH	Shrub – Willow	7
Zone 13	PGH	Tree – Aspen	158
Zone 13	PGH	Tree - Lodgepole Pine	13
Zone 13	PGH	Tree – Spruce-Fir	4
Zone 13	PPH	Forb, Shrub	161
Zone 13	PPH	Tree – Aspen	43
Zone 13	PPH	Tree – Spruce-Fir	2
		Zone 13 Total	**980**
Zone 14	PGH	Forb, Grass, Sagebrush	139
Zone 14	PGH	Shrub	42
Zone 14	PGH	Shrub – Willow	24
Zone 14	PGH	Tree – Aspen	20
Zone 14	PPH	Forb, Grass, Sagebrush	529
Zone 14	PPH	Shrub – Willow	20
Zone 14	PPH	Tree – Aspen	21
Zone 14	PPH	Tree - Lodgepole Pine	3
		Zone 14 Total	**825**

VI. THREATENED, ENDANGERED, PROPOSED AND CANDIDATE SPECIES

A Biological Assessment (BA) will be prepared for the selected alternative developed for the Record of Decision(s) and included with the FEIS developed for this project. The BA will conform to the legal requirements set forth under section 7 of the Endangered Species Act (ESA) (19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14). Section 7(a) (1) of the ESA requires federal agencies to use their authorities to further the conservation of listed species. Section 7(a) (2) requires that federal agencies ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of federally-listed species, or destroy or adversely modify designated critical habitat. A BA must be prepared for federal actions to evaluate the potential effects of the proposal on listed or proposed species. The contents of the BA are at the discretion of the federal agency, and will depend on the nature of the federal action (50 CFR 402.12(f)).

A BA is not included with this DEIS. This section of the Wildlife Specialist Report provides preliminary background information that will be utilized in the development of a BA, for the selected alternative, and also provides insight into the currently anticipated effects to threatened, endangered, proposed and candidate species. Species identified by the USFWS as 'candidate' species have no ESA protections but by USFS policy, they are designated as Regional Forester 'sensitive species' and afforded special management attention by the US Forest Service. They are analyzed in the Biological Evaluation developed for the FEIS and are discussed in the sensitive species section of this specialist report, if they occur on the RNF.

A list of threatened, endangered, proposed, and candidate (TEPC) species was determined for this project in consultation with the USFWS. A preliminary list of TEPC species was obtained via download from the USFWS website (http://ecos.fws.gov/ipac/) on December 7, 2012. This list included a total of 34 species including 17 species listed as 'threatened', 9 species listed as 'endangered', 3 species listed as 'proposed' and 5 'candidate' species, including the greater sage-grouse[1]. There currently is no designated critical habitat for threatened or endangered species on the RNF.

Of the 29 TEP species, a preliminary evaluation by the BLM and USFS indicated the potential need to evaluate 24 of the 29 TEP species in a BA. The BLM requested advice on this proposed list in a letter to the USFWS on February 12, 2013. The USFWS returned a letter to the BLM on March 13, 2013 with some recommended changes to the list of species submitted. Table 3 documents the species identified through this process.

Table 4 is the list of species likely to be included in the Biological Assessment prepared for the selected alternative. Two candidate species may be carried forward in BA because their status may change to 'Proposed' during the completion of this planning process. Table 4 also presents a preliminary potential determination on the effects of implementing an action alternatives to the species identified. Overall it is generally assumed that implementation of any of the action alternatives that adds additional conservation measures for greater sage-grouse may also result in indirect positive outcome for other listed species associated with sage-grouse or sagebrush habitats, if they occur in the area where the conservation measures are applied. Negative

[1] At the time the list was generated the wolverine had recently been changed from a 'candidate' species to a 'proposed' species. The IPAC system had not been updated at the time of the access to reflect this change, however the species was accounted for in the tally of 'proposed' species in our correspondence with the USFWS to reflect the new status.

consequences to other listed species are not envisioned as an outcome of selection of any of the alternatives. Table 4 utilizes a coarse filter approach to evaluate potential effects to TEP species resulting from an action alternative and which species to carry forward for detailed analysis.

1. Suitable habitat and/or elevation range does not exist for the species within existing mapped greater sage-grouse designated habitat occurring in the analysis area.
2. Individual animals may be accidental, dispersing, migrating, happenstance, vagrant, nomadic or opportunistic visitors to areas of mapped habitat (ADH), but no affiliation or dependence upon these habitats is known.
3. The proposed conservation measures associated with an action alternative or existing species-specific conservation recovery plans/strategies are likely to eliminate any potential for adverse impact to the species or its habitat.
4. The coarse filter evaluation has not resulted in a preliminary indication that the alternatives are clearly likely to result in "no effect" and therefore the species will be carried forward for a more detailed analysis.

Table 3. USFWS endangered, threatened, proposed and candidate species, occurring, potentially occurring or with potential habitat, or those that may be affected by management actions occurring in the analysis area of the DEIS. Candidate species have no formal status and protections under the Endangered Species Act. Candidate species that are being considered for a change to a proposed status may be included in the Biological Assessment prepared for the FEIS. Other candidate species, including the greater sage-grouse, may be addressed in other sections of the DEIS and subsequent FEIS, including the Biological Evaluation, but outside of the Biological Assessment process.

COMMON NAME	SCIENTIFIC NAME	CURRENT FEDERAL STATUS	SPECIES IN IPAC 12/7/2012	SPECIES RECOMMENDED BY BLM/USFS TO ADDRESS IN BA (2/12/2013 Letter)	LIST OF SPECIES RECOMMENDED BY USFWS TO ADDRESS IN BA. (3/13/2013 Letter)
Birds					
Greater sage-grouse	*Centrocercus urophasianus*	Candidate	Yes	No	No
Gunnison sage-grouse	*Centrocercus minimus*	Proposed	Yes	Yes	No
Mexican spotted owl	*Stric occidentalis lucida*	Threatened	Yes	Yes	Yes
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Yes	No	Yes
Least tern	*Sterna antillarum*	Threatened	Yes	No	Yes
Piping plover	*Charadrius melodus*	Threatened	Yes	No	Yes
Whooping crane	*Grus americana*	Endangered	Yes	No	Yes
Fishes					
Bonytail club	*Gila elegans*	Endangered	Yes	Yes	Yes
Colorado pikeminnow	*Ptchocheilus lucius*	Endangered	Yes	Yes	Yes
Greenback cutthroat trout	*Onchorhynchus clarki ssp. Stomias*	Threatened	Yes	Yes	Yes
Humpback chub	*Gila cypha*	Endangered	Yes	Yes	Yes
Razorback sucker	*Xyrauchen texanus*	Endangered	Yes	Yes	Yes
Pallid Sturgeon	*Scaphirhynchus albus*	Threatened	Yes	No	Yes
Plants					
Colorado butterfly plant	*Gaura neomexicana var.*	Threatened	Yes	Yes	No

COMMON NAME	SCIENTIFIC NAME	CURRENT FEDERAL STATUS	SPECIES IN IPAC 12/7/2012	SPECIES RECOMMENDED BY BLM/USFS TO ADDRESS IN BA (2/12/2013 Letter)	LIST OF SPECIES RECOMMENDED BY USFWS TO ADDRESS IN BA. (3/13/2013 Letter)
	coloradensis				
Colorado hookless cactus	*Sclerocactus glaucus*	Threatened	Yes	Yes	Yes
Debeque phacelia	*Phacelia submutica*	Threatened	Yes	Yes	Yes
Dudley Bluffs bladderpod	*Lesquerella congesta*	Threatened	Yes	Yes	Yes
Dudley Bluffs twinpod	*Physaria obcordata*	Threatened	Yes	Yes	Yes
Graham beardtongue	*Penstemon grahamii*	Proposed	Yes	Yes	Yes
North Park phacelia	*Phacelia formosula*	Endangered	Yes	Yes	Yes
Osterhout milkvetch	*Astragalus osterhoutii*	Endangered	Yes	Yes	Yes
Parachute beardtongue	*Penstemon debilis*	Threatened	Yes	Yes	Yes
Penland alpine fen mustard	*Eutrema penlandii*	Threatened	Yes	Yes	No
Penland beardtongue	*Penstemon penlandii*	Endangered	Yes	Yes	Yes
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	Yes	Yes	Yes
White River beardtongue	*Penstemon scariosus var. albifluvis*	Candidate	Yes	No	Yes
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Yes	No	Yes
Insects					
Arapahoe snowfly	*Capnia arapahoe*	Candidate	Yes	No	No
Uncompahgre Fritillary butterfly	*Boloria acrocnema*	Endangered	Yes	Yes	No
Mammals					
Black-footed ferret	*Mustela nigripes*	Endangered	Yes	Yes	Yes
Black-footed ferret	*Mustela nigripes*	Exp. Non-Essential	Yes	No	No
Canada lynx	*Lynx canadensis*	Threatened	Yes	Yes	Yes

COMMON NAME	SCIENTIFIC NAME	CURRENT FEDERAL STATUS	SPECIES IN IPAC 12/7/2012	SPECIES RECOMMENDED BY BLM/USFS TO ADDRESS IN BA (2/12/2013 Letter)	LIST OF SPECIES RECOMMENDED BY USFWS TO ADDRESS IN BA. (3/13/2013 Letter)
Gunnison's prairie dog	*Cynomys gunnisoni*	Candidate	Yes	No	No
North American wolverine	*Gulo gulo luscus*	Proposed	Yes	Yes	Yes
Preble's meadow jumping mouse	*Zapus hudsonius ssp. Preblei*	Threatened	Yes	Yes	No

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Table 4. USFWS endangered, threatened, proposed and candidate species likely to be included in the Biological Assessment prepared for the FEIS and preliminary determinations. The two candidate species that are included on the list, are included because they are likely to change to a 'proposed' status during the completion of this project timeline. This list includes TEP species across the entire analysis area of the DEIS.

COMMON NAME	ESA STATUS	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY DETERMINATION ON EFFECTS TO SPECIES FROM IMPLEMENTATION OF AN ALTERNATIVE
Birds					
Mexican spotted owl	Threatened	No	No	1, 2	No Effect
Yellow-billed cuckoo	Candidate likely changing to Proposed	Yes	Yes	3	No Effect
Least tern	Threatened	No	No	3	No Effect
Piping Plover	Threatened	No	No	3	No Effect
Whooping crane	Endangered	No	No	3	No Effect
Fishes					
Bonytail club	Endangered	No	No	3	No Effect
Colorado pikeminnow	Endangered	No	No	3	No Effect
Greenback cutthroat trout	Threatened	No	No	3	No Effect
Humpback chub	Endangered	No	No	3	No Effect
Razorback sucker	Endangered	No	No	3	No Effect
Pallid Sturgeon	Threatened	No	No	3	No Effect
Plants					
Colorado hookless cactus	Threatened	Yes	Yes	3	No Effect
Debeque phacelia	Threatened	Yes	Yes	3	No Effect

COMMON NAME	ESA STATUS	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY DETERMINATION ON EFFECTS TO SPECIES FROM IMPLEMENTATION OF AN ALTERNATIVE
Dudley Bluffs bladderpod	Threatened	No	No	3	No Effect
Dudley Bluffs twinpod	Threatened	No	No	3	No Effect
Graham beardtongue	Proposed	Yes	Yes	3	No Effect
North Park phacelia	Endangered	Yes	Yes	3	No Effect
Osterhout milkvetch	Endangered	Yes	Yes	3	No Effect
Parachute beardtongue	Threatened	Yes	Yes	3	No Effect
Penland beardtongue	Endangered	Yes	Yes	3	No Effect
Ute ladies'-tresses	Threatened	No	No	3	No Effect
White River beardtongue	Candidate likely changing to Proposed	No	No	3	No Effect
Western prairie fringed orchid	Threatened	No	No	3	No Effect
Mammals					
Black-footed ferret	Endangered	Yes	Yes	3	No Effect
Canada lynx	Threatened	No	No	1, 2	No Effect
North American wolverine	Proposed	No	No	1, 2	No Effect

VII. USFS SENSITIVE SPECIES ON THE ROUTT NATIONAL FOREST

Forest Service policy requires that a review of programs and activities, through a biological evaluation (BE), be conducted to determine their potential effect on threatened and endangered species, species proposed for listing, and sensitive species (FSM 2670.3). This section of the wildlife specialist report provides a preliminary analysis that will be utilized to develop the BE specific to sensitive species that will be prepared for this project which will be included with the FEIS.

The purpose of a BE for this planning project is to analyze and determine the likely effects of the alternatives associated with the GRSG planning effort on Forest Service sensitive species (FSM 2670.31-2670.32), including the GRSG, for the RNF.

Sensitive species in Region 2 are listed on the Regional Forester's sensitive species list and are composed of plants, birds, mammals, amphibians, reptiles, fish, and invertebrates. We conducted a review for Region 2 sensitive species that may occur or be affected by activities associated with the Plan amendment DEIS and subsequent RNF Plan Amendment for the GRSG. Existing occurrence information, as well as known or potential habitat, was reviewed by searching the Natural Resource Management (NRM) database. Sources of information contained in this database include Forest Service records and files, the Colorado Natural Heritage Program, Colorado Parks & Wildlife information, and published research.

Table 5 is a list of species designed by the Regional Forester as 'sensitive' species identified for consideration on the RNF. All of the species in Table 5 were considered in this analysis and compared to the five criteria listed below. Criteria 1-4 are used to identify species that would likely experience "no impact" from the implementation of an action alternative and could therefore be eliminated from a more detailed analysis. Criterion number 5 indicates that the species should be carried forward for a more analysis to clarify the potential effects. The criteria are as follows:

1. Suitable habitat and/or elevation range does not exist for these species in the GRSG ADH on the RNF.
2. The type or intensity of the activity in the proposed action is expected to have no impact on these species or their habitat.
3. Individual animals may be accidental, dispersing, migrating, happenstance, vagrant, nomadic or opportunistic visitors to the ADH habitat(s), but no affiliation or dependence upon these habitat(s) has been shown.
4. The associated conservation design or mitigations eliminate any potential for impact to the species.
5. The coarse filter evaluation has not resulted in a preliminary indication that the alternatives are clearly likely to result in "no impact" and therefore the species will be carried forward for a more detailed analysis.

Species in Table 5 are likely to occur within or near the analysis area, or with potential habitat in or near the analysis area that may be affected (negatively or positively, directly, indirectly and/or cumulatively) by implementation of an action alternative were it carried forward into Table 6, and a more detailed analysis of the project effects was subsequently conducted.

Table 5. USDA Forest Service Region 2 sensitive species occurring or potentially occurring on the Routt National Forest that may be influenced by an action alternative and will be further analyzed in this document. While candidate species have no formal status and protections under the Endangered Species Act, in the Rocky Mountain Region they are provided sensitive species status and effects to candidate species are evaluated through the biological evaluation process.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
AMPHIBIANS						
Boreal toad	*Anaxyrus boreas boreas*	Wetlands at elevations from 2,250 to 3,600 meters.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Northern leopard frog	*Lithobates pipiens*	Cooler climates, broad use of uplands and wetlands.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Wood frog	*Lithobates sylvatica*	Wide range of aquatic and moist habitats.	Y	Y	5	To be determined in FEIS, detailed analysis below.
BIRDS						
American peregrine falcon	*Falco peregrinus anatum*	Nest sites on cliffs with a wide view, low disturbance, and abundance of prey.	N	N	1, 2	No Impact
Bald eagle	*Haliaeetus leucocephalus*	Generally aquatic habitats and prefer fish for prey.	N	N	1, 2, 3	No Impact

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
Black swift	*Cypseloides niger*	Nest on cliffs near waterfalls.	N	N	1, 2	No Impact
Boreal owl	*Aegolius funereus*	Mature to late-successional Engelmann spruce and subalpine fir above 2,745 meters.	N	N	1, 2	No Impact
Brewer's sparrow	*Spizella breweri*	Sagebrush-obligate that gleans insects and eats seeds.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	Sagebrush grasslands with forbs and insects for broods.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Flammulated owl	*Otus flammeolus*	Forest owl that nests in cavities and caves from 6,000 to 10,000 ft.	N	N	1, 2	No Impact
Greater Sage-Grouse	*Centrocercus urophasianus*	Sagebrush hills, with forbs and insects for broods below 8,400 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Lewis's woodpecker	*Melanerpes lewis*	Open ponderosa pine forest, open riparian woodlands dominated by	N	N	1, 3	No Impact

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
		cottonwood, and burned pine forests.				
Loggerhead shrike	*Lanius ludovicianus*	Grasslands, shrublands, and agricultural lands.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Northern goshawk	*Accipiter gentilis*	Mature forests, large trees on moderate slopes with open understories for breeding.	N	N	1, 2	No Impact
Northern harrier	*Circus cyaneus*	Wetlands or grasslands with tall dense vegetation and high residual cover.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Olive-sided flycatcher	*Contopus cooperi*	Forest openings and edges.	N	N	1, 2	No Impact
Purple martin	*Progne subis*	Relatively large old growth aspen near standing or free-flowing water.	Y	Y	1, 2	No Impact
Sage sparrow	*Amphispiza bellii*	Shrublands dominated by big sagebrush with a perennial bunchgrass	Y	Y	5	To be determined in FEIS, detailed analysis below.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
		understory.				
White-tailed ptarmigan	*Lagopus leucurus*	Alpine ecosystems at or above treeline.	N	N	1, 2	No Impact
Yellow-billed cuckoo	*Coccyzus americanus*	Open woodlands with an understory of dense vegetation, near water.	N	N	1	No Impact
FISH						
Mountain sucker	*Catostomus platyrhynchus*	Lotic waters, from small montane streams to large rivers.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Roundtail chub	*Gila robusta*	Colorado River drainage.	N	N	1, 2	No Impact
Yellowstone cutthroat trout	*Oncorhynchus clarkii bouveri*	Found in diverse habitats from beaver ponds to high gradient cold water streams.	N	N	1, 2	No Impact
Colorado River cutthroat	*Oncorhynchus clarkii pleuriticus*	Cold, clean water environments within high elevation streams and lakes.	Y	Y	5	To be determined in FEIS, detailed analysis below.
INSECTS						
Hudsonian emerald	*Somatochlora hudsonica*	Deep sedge-bordered lakes and	N	N	1, 3	No Impact

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
		ponds.				
MAMMALS						
North American wolverine	*Gulo gulo luscus*	Remote habitats within the conifer, subalpine, and tundra zones.	N	N	2, 3	No Impact
Townsend's big-eared bat	*Corynorhinus townsendii*	Mature forest canopies and edges.	N	N	1, 3	No Impact
Spotted bat	*Euderma maculatum*	Cliffs and open and dense deciduous and coniferous forests, hay fields, deserts, marshes, riparian areas.	N	N	1, 2	No Impact
Hoary bat	*Lasiurus cinereus*	Woodland, mainly coniferous forests.	N	N	1, 2	No Impact
River otter	*Lontra canadensis*	Permanent water, of relatively high quality, and with an abundant food base of fish and crustaceans.	N	N	1, 3	No Impact
American marten	*Martes americana*	Mature and old-growth spruce-fir and lodgepole forests.	N	N	1, 2, 3	No Impact

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
Fringed myotis	*Myotis thysanodes*	Caves, mines, cliffs, abandoned buildings, and snags.	N	N	1, 2	No Impact
Rocky Mountain bighorn sheep	*Ovis canadensis canadensis*	Open or semi-open terrain with a mix of steep and gentle slopes, broken cliffs, rock outcrops, and canyons.	N	N	1, 2	No Impact
Pygmy shrew	*Sorex hoyi*	Forest conditions, from subalpine to boggy meadows, to willow thickets.	N	N	1, 2, 3	No Impact
MOLLUSCS						
Rocky Mountain capshell	*Acroloxus coloradensis*	Cold mountain lakes and in very slow moving rivers.	N	N	1, 2	No Impact
PLANTS						
Sea pink	*Armeria maritima spp. sibirica*	Grassy tundra slopes, on wet, sandy, or spongy organic soils; 11,900-13,000 ft.	N	N	1	No Impact
Park Milkvetch	*Astragalus leptaleus*	Moist swales and meadows; 6,500-	Y	Y	5	To be determined in FEIS, detailed

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
		9,500 ft.				analysis below.
Narrowleaf moonwort	*Botrychium lineare*	Disturbed sites, grassy slopes among medium height grasses, along edges of streamside forests, alpine areas & aspen forests; 7,900-11,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Paradox moonwort	*Botrychium paradoxum*	Grassy meadows, gravelly road sides, low herbaceous cover under small conifer saplings; probably at 5,000–9,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Lesser panicled sedge	*Carex diandra*	Wet meadows and subalpine willow carrs; 7,000-9,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Livid sedge	*Carex livida*	Fens and wetlands; 9,000-10,000 ft.	N	N	1	No impact
Lesser yellow lady's slipper	*Cypripedium parviflorum*	Moist forests and aspen groves; 7,400-8,500 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
clawless draba	*Draba exunguiculata*	Alpine and subalpine on tundra, gravelly slopes or fell fields; 11,500-14,000 ft. central Colorado, including Chaffee, Clear Creek, Huerfano, and Park counties.	N	N	1	No impact
Gray's peak whitlowgrass	*Draba grayana*	Alpine on rocky and gravelly slopes or fell fields, usually on granitic substrates; 12,000-14,000 ft.	N	N	1	No impact
roundleaf sundew	*Drosera rotundifolia*	Amongst Sphagnum on the margins of ponds, fens, and floating peat mats; 9,100-9,800 ft.	N	N	1	No impact
elliptic spikerush	*Eleocharis elliptica*	Wetlands; widely distributed in North America but with few confirmed CO records.	Y	Y	5	To be determined in FEIS, detailed analysis below.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
Dropleaf Buckwheat (slender leaved buckwheat)	*Eriogonum exilifolium*	Sagebrush flats; North and Middle Parks. 7,500-9,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Whitebristle cottongrass (altai cottongrass)	*Eriophorum altaicum var. neogaeum*	Alpine wetlands; 9500-14,000 ft.	N	N	1	No Impact
slender cottongrass	*Eriophorum gracile*	Montane and subalpine wetlands, wet meadows and pond edges; 8,100-12,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Plains rough fescue (Hall's fescue)	*Festuca hallii*	Alpine and subalpine grasslands and meadows; 11,000-12,000 ft.	N	N	1	No Impact
Weber's Scarlet gilia (Rabbit Ears gilia)	*Ipomopsis aggregata ssp. weberi*	Forb or shrub dominated montane meadows; 6,560-10,500 ft. - a narrow endemic known from the Park Range.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Simple bog sedge	*Kobresia simpliciuscula*	Alpine areas including tundra,	N	N	1	No Impact

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
(Kobresia)		fens, moist gravel, and glacial outwash.				
Colorado tansyaster	*Machaeranthera coloradoensis var. coloradensis*	Mountain parks, slopes & rock outcrops & dry tundra; 8,500–12,500 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
White adder's-mouth orchid	*Malaxis brachypoda*	Riparian areas, 7,200-8,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Weber's (Rocky Mountain) monkeyflower	*Mimulus gemmiparus*	Granitic seeps, slopes, and alluvium in open sites within spruce-fir and aspen forests; 8,500-10,500 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Kotzebue's grass of Parnassus	*Parnassia kotzebuei*	Alpine and subalpine, in wet rocky areas, amongst moss mats and along streamlets; 10,000-12,000 ft.	N	N	1	No Impact
Harrington's beardtongue	*Penstemon harringtonii*	Known primarily from sagebrush	Y	Y	5	To be determined in FEIS, detailed

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
		communities, often on calcareous substrates; 6,400-9,400 ft.				analysis below.
Rock cinquefoil (front range cinquefoil)	*Potentilla rupincola*	Cracks in granite rock outcrops: 6,500 to 10,900 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Ice cold buttercup	*Ranunculus karelinii (= R. gelidus ssp. grayi)*	Alpine slopes and summits amongst rocks and scree; 10,000-14,100 ft.	N	N	1	No Impact
Dwarf raspberry (nagoon berry)	*Rubus arcticus var. acaulis (= Cylactis arctica ssp. acaulis)*	Understory of spruce and willow dominated communities, boggy woods, and mountain meadows at 7,000-9,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Sageleaf willow (hoary willow)	*Salix candida*	Wetlands in willow carrs and mossy streamsides; 8,600-9,700 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Autumn willow	*Salix serissima*	Wetland areas including marshes, fens, and bogs; 7,800-10,200 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
Club spikemoss (northern spikemoss)	*Selaginella selaginoides*	Marshy areas and wet spruce forests; east side of the Park Range.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Sphagnum	*Sphagnum angustifolium*	Peat bogs, conifer forests and moist tundra areas.	N	N	1	No Impact
Baltic sphagnum	*Sphagnum balticum*	Fens amongst other moss, sedges, and willows; 9,000–10,000 ft.	N	N	1	No Impact
Largeflower triteleia	*Triteleia grandiflora*	Full sunlight to partial shade in meadows, grasslands, sagebrush, pinyon-juniper woodlands, aspen woodlands, pine forests, and scattered woodlands. 7,760 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.
Lesser bladderpod	*Utricularia minor*	Shallow water of subalpine ponds; 5,500-9,000 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.

COMMON NAME	SCIENTIFIC NAME	HABITAT DESCRIPTION & RANGE	KNOWN OR SUSPECTED TO OCCURR IN ADH?	SUITABLE HABITAT IN ADH?	EVALUATION CRITERIA	PRELIMINARY BIOLOGICAL DETERMINATION FOR THE DEIS
Selkirk's violet	*Viola selkirkii*	Forests from montane to subalpine; 6,000-9,100 ft.	Y	Y	5	To be determined in FEIS, detailed analysis below.

Table 6. Summary list of Regional Foresters designated 'sensitive' species which are analyzed in greater detail for this analysis and included in a Biological Evaluation in the FEIS

Common name	Scientific name	Habitat affinity
AMPHIBIANS		
Boreal toad	*Anaxyrus boreas boreas*	WET, WST
Northern leopard frog	*Lithobates pipiens*	WET, WST
Wood frog	*Lithobates sylvatica*	WET, WST
BIRDS		
Brewer's sparrow	*Spizella breweri*	MS, S
Columbian sharp-tailed grouse	*Tympanuchus phasianellus*	MS, S
Greater Sage-Grouse	*Centrocercus urophasianus*	MS, S
Loggerhead shrike	*Lanius ludovicianus*	MS, FM, RIP
Northern harrier	*Circus cyaneus*	MS, RIP, WET, GRA
Sage sparrow	*Amphispiza bellii*	MS, S
FISH		
Mountain sucker	*Catostomus platyrhynchus*	WST
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	WST
PLANTS		
Park milkvetch	*Astragalus leptaleus*	Meadow
narrow-leaved moonwort	*Botrychium lineare*	Meadow
paradox moonwort	*Botrychium paradoxum*	Meadow
lesser panicled sedge	*Carex diandra*	Wetland
lesser yellow lady's slipper	*Cypripedium parviflorum*	Forest (wet)
elliptic spikerush	*Eleocharis elliptica*	Wetland
dropleaf buckwheat	*Eriogonum exilifolium*	Shrubland (dry)
slender cotton-grass	*Eriophorum gracile*	Wetland
Weber's scarlet-gilia	*Ipomopsis aggregata* ssp. *weberi*	Meadow
Colorado tansy aster	*Machaeranthera coloradoensis*	Dry Shrub
White adder's-mouth orchid	*Malaxis brachypoda*	Forest (wet)
Weber's monkey flower	*Mimulus gemmiparus*	Wetland
Harrington beardtongue	*Penstemon harringtonii*	Shrubland (dry)
rock cinquefoil	*Potentilla rupincola*	Rock outcrops
dwarf raspberry	*Rubus arcticus* var. *acaulis*	Wetland Forest (wet)
hoary willow	*Salix candida*	Wetland
autumn willow	*Salix serissima*	Wetland
club spikemoss	*Selaginella selaginoides*	Wetland
largeflower triteleia	*Triteleia grandiflora*	Meadow, Shrubland (dry)
lesser bladderpod	*Utricularia minor*	Wetland (aquatic)
Selkirk violet	*Viola selkirkii*	Forest
Key: *AQ = Aquatic; SF = Spruce-fir; LPP = Lodgepole pine; FM = Forest meadows; GRA = Grassland; MS = Mountain shrub; RIP = Riparian; S = Sagebrush; WAT = Water; WET = Marshes, shallow ponds; WST = Streams*		

A. Greater sage-grouse

General biological information on the status, distribution, threats and trends to greater sage-grouse the analysis area are described in the DEIS. This information is not repeated in this section unless specific to GRSG habitats or populations occurring on the RNF.

Within the analysis area, the management direction proposed in the action alternatives would apply to designated GRSG habitats (PPH, PGH & linkage areas) on the RNF (Figure 1). There are no areas designed as linkage areas on the RNF. On the RNF this consists of approximately 12,501 acres of ADH (PPH and PGH) or approximately 1% of the of the RNF land area. Of the ADH on the RNF, 1,571 acres are PPH (13%), and 10,930 acres are PGH (87%). Each of the three Ranger Districts on the Forest contain some GRSG habitat. The Hahns Peak/Bears Ears District contains the most habitat with 9,982 acres of PGH, the Yampa District contains 1,262 acres including both PGH and PPH, and the Parks District contains1,257 acres including both PGH and PPH (Table 1). State and private land inholdings also occur within the National Forest boundary and include sage-grouse habitat as described in Table 1. The breakdown of vegetation cover types on the RNF by GRSG Colorado management zone are described in Table 2.

There are no active sage-grouse leks on the RNF, but there is one historic lek in Slater Park area of the Hahns Peak Bears Ears Ranger District. A few observations of individual birds have been recorded on the RNF near Forest Road 8 and Spronks creek near the Flat Tops Wilderness Area (Colorado management zone 14), in Slater Park near a Columbian sharp-tailed grouse lek (Colorado management zone 7), and also north of Toponas, near Forest Road 285 (management zone 14) (December 2012 NRM Database). The primary GRSG use of the RNF is in Colorado Management Zones 11, 13 & 14 and most likely is utilized as summer brood rearing habitat, whereas the RNF lands in Colorado Management Zone 7 are only occasionally utilized and have not been recently documented to be used as breeding, brood rearing or wintering habitats for GSG. It is unlikely that GRSG habitats on the RNF provide winter habitats due to the higher elevational nature of these sites and the deeper winter snow conditions associated with them.

Most of the GRSG habitat on the RNF is composed of small areas that are peripheral to more extensive habitats occurring in lower elevation areas not managed by the US Forest Service. As a result of the peripheral nature of the habitat on the RNF, GRSG use is most likely limited to summer brood rearing. Due to the absence of active leks on the RNF, the absence of suitable wintering habitat on the RNF, and due to the limited summer habitats available, the populations of GRSG that utilize the RNF (Populations in Co. Mgt. Zones 7, 11, 13, & 14) are highly dependent on habitats managed under other land ownerships for their continued survival.

The GRSG populations identified in this DEIS are largely analogous to subpopulations of sage-grouse described in the COT report (USFWS 2013). These are slightly different, as the Colorado Management Zones are limited to the state of Colorado and some of the COT populations cross state lines. The four populations on the RNF include:

- Colorado Management Zone 7 = COT Report NW Colorado population (unit 9e)[2]
- Colorado Management Zone 11 = COT Report North Park population (unit 9d)
- Colorado Management Zone 13 = COT Report Middle Park population (unit 6)

[2] COT unit 9e includes Colorado management zone 7 population, as well as several other Colorado Management Zone populations

- Colorado Management Zone 14 = COT Report Eagle South Routt population (unit 5)

The majority of habitat on the Routt NF is in close proximity to populations 9d and 9e. These populations are southern extensions of the much larger Wyoming Basin population, and are well-connected to that population which has a high likelihood of persistence. Both 9d and 9e populations appear relatively stable. The Eagle South Routt population (CMZ 14/COT 5) is a small, isolated population. The RNF contributes very few surface acres [1262 acres of habitat (663 acres of PGH and 599 acres of PPH)] to this population. The small size and isolation of this population are factors that increase the challenge of long-term persistence, particularly if larger adjacent populations undergo contractions and farther separated from this population. Similarly, the Middle Park population (CMZ 13/COT 6) is also isolated and vulnerable to similar risks as the Eagle South Routt population. The RNF represents a small fraction of the suitable habitat to these populations.

Table 7. Data from the Conservation Objective Team Report (Table 2) on the 4 populations occurring on the Routt National Forest (USFWS 2013).

Population Area	**<200 Males/500 Birds**	**% Chance of <50 birds/20 males in 2037**	**% Chance of <500 birds/200 males in 2037**	**% Chance of <50 birds/20 males in 2107**	**% Chance of <500 birds/200 males in 2107**
Management Zone II: Wyoming Basin	NA	0.1	0.2	16.1	16.2
9d – North Park	No	0	0	9.9	10.7
9e - NWCO	No	0	0	9.9	10.7
5 – Eagle South Routt	Yes	ND	ND	ND	ND
6 – Middle Park	No	2.5	100	7.1	100

Threats by Population

Threats facing these populations identified in the Conservation Objectives Team report (USFWS 2013). Each of the threats was evaluated relative to the RNF. Although the Routt NF contributes a small amount of habitat to the overall sage-grouse populations, Forest Service regulation requires management actions that ensure the conservation of habitats that allows the persistence of populations on NFS administered lands. Management guidance reducing these threats, thereby protecting sage-grouse habitats, will be incorporated into the RNF amendment under all action alternatives.

Table 8. Data from the Conservation Objective Team Report (Table 2) on the 4 populations occurring on the Routt National Forest (USFWS 2013). Threats to GRSG on the Routt National Forest is not part of the COT report, but rather an interpretation of the relative risk to GRSG from the identified threat on the RNF. Threats are defined as: Y= threat is present and widespread, L = threat present but localized, N = threat is not known to be present, and U = Unknown (USFWS 2013).

Conservation Objectives Team Report Population Area	**Isolated/Small Size**	**Sagebrush Elimination**	**Agriculture Conversion**	**Fire**	**Conifer Encroachment**	**Weeds/Invasive Species**	**Energy**	**Mining**	**Infrastructure**	**Grazing**	**Equids**	**Recreation**	**Urbanization**
North Park: 9d	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y
NWCO: 9e	N	L	Y	Y	L	Y	Y	Y	Y	Y	L	Y	Y
Eagle South Routt: 5	Y	L	Y	L	L	Y	Y	N	Y	Y	N	L	Y
Middle Park: 6	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y
Threats to GRSG on the RNF	Y	L	N	L	L	L	N	N	N	Y	N	L	N

B. Amphibians

Amphibian species are associated with wetland areas that occur within the matrix of sage-grouse habitats (ADH) and thus could be influenced by management actions occurring in these areas as a result of changes in Forest Plan direction. There are three sensitive amphibian species that occur within these areas on the RNF including: the boreal toad, northern leopard frog and wood frog.

Boreal toad (Anaxyrus boreas boreas)

Boreal toads, according to Keinath and McGee (2005), were once widely distributed in Region 2 but have declined dramatically during the last 25 years. The overall range of the toad has contracted slightly, but its distribution within that range has been greatly reduced in the Rocky Mountain Region geographically isolating some populations thereby causing them to be more susceptible to local extirpation. Several boreal toad breeding sites have been documented on the RNF (December 2012 NRIS Wildlife database). Within sage-grouse habitat areas they are known to occur in the California Park and by Muddy Pass areas of the RNF.

Boreal toads are associated with a variety of habitats, including wetlands, forests, woodlands, sagebrush, meadows, and floodplains in the mountains and valleys. Usually they inhabit wetlands near ponds, lakes, reservoirs, rivers and streams. They require 3 main habitat components; 1) shallow wetlands for breeding, 2) terrestrial habitats with vegetative cover for foraging, and 3) burrows for winter hibernation (Loeffler 2001).

Threats to boreal toads include: chytrid fungus *Batrachochytrium dendrobatidis*, acidification of wetlands, timber harvesting that causes sedimentation, livestock grazing/trampling in and around riparian areas, pesticides and herbicides, and introduced species which prey on toads or create competition for resources or are vectors for pathogens (Keinath and McGee 2005). Any activity that affects suitable wetland habitats could affect boreal toad populations.

Northern leopard frog (Lithobates pipiens)

The northern leopard frog is a medium sized frog (5.1 to 9.0 cm snout-vent length), with brown or green background color, and two or three irregular rows of dark spots on the back (Conant and Collins 1991).

Northern leopard frogs have been found throughout much of USFS Region 2, including Colorado and the RNF. Despite this distribution there have been significant declines and localized extirpations. There have been numerous detections of northern leopard frogs have been on the RNF (December 2012 NRIS Wildlife database). Currently, the only part of the RNF where they have been documented in conjunction with designated greater sage-grouse habitat, is in PGH occurring in the California Park area. Historically, they were likely found across the entire RNF and additional surveys would probably lead to more detections of this species. They are also known to be present on private land adjacent to the RNF in small reservoirs and along the Yampa River.

Northern leopard frogs need a wide range of habitats in close proximity including: wetland habitats with shallow quiet waters, upland areas in grassy meadows to feed, and the bottoms of flowing streams and ponds that are large enough to freeze so that they can overwinter (Smith and Keinath 2007).

Threats to the Northern leopard frog include habitat loss and fragmentation, fish stocking in fishless ponds that are critical to frog reproduction, introduction of diseases, impacts from livestock and wild ungulates, and water quality degradation from pesticides, acid rain, fertilizers and other chemicals (Smith and Keinath 2007).

Wood frog (Lithobates sylvaticus)

The wood frog is a moderate sized frog (3.2 to 8.2 cm snout-vent length), with many color variations including light tan to dark brown, olive, green, gray and pink (Muths et al. 2005). Wood frogs use a wide range of aquatic and moist habitats including both aquatic and terrestrial stages.

According to Muths et al. (2005), in Region 2 there are isolated, relict populations of wood frogs. Numerous wood frogs have been documented on the RNF; however, none have been documented in designated greater sage-grouse habitat (December 2012 NRIS Wildlife database). The only sites with suitable habitat and potential for occurrence are in PPH and PGH on the Parks Ranger District north of Walden, CO, near Muddy Pass and near North Ryder Peak (GSG management zone 13).

Threats to wood frogs include: habitat fragmentation and loss, degradation of wetlands and moist meadows, drought, roads and human activity, and poor water quality from pollutants such as herbicides, fire retardants and chemical road de-icers (Muths et al. 2005).

C. Birds

Brewer's sparrow (Spizella breweri)

The Brewer's sparrow is a small passerine (song-bird) that inhabits arid sagebrush communities. It is a shrub nesting species that generally produce three to four eggs per nest and are capable of producing more than one brood in a nesting year. Brewer's sparrows primarily forage in shrubs gleaning insects (Holmes and Johnson 2005a) and secondarily consume seeds from the ground. Brewer's sparrows are a common occurrence throughout Colorado and Wyoming and based on habitat, perhaps 50 percent of the population may occur on National Forest System lands within this area (Holmes and Johnson 2005). Breeding Bird Survey (BBS) suggests that there has been a slight decline (2%) in numbers since around 1970 (Holmes and Johnson 2005). Numerous Brewer's sparrows have been documented on the RNF, including in the analysis area in both PGH and PPH (December 2012 NRIS Wildlife database).

Throughout their range, Brewer's sparrows are associated with big sagebrush (*Artemisia tridentata spp.*) dominated landscapes and are considered to be a sagebrush-obligate species (Paige and Ritter 1999). They prefer sagebrush cover averaging 13% and not exceeding 50%, and seem to be strongly influenced by landscape-level habitat changes, however more research in needed in this area (Bock and Bock 1987, Braun et al. 1976, Rotenberry et al. 1999, Wiens and Rotenberry 1981). Minimum patch size and degree of isolation have not been determined, however, some researchers have suggested that Brewer's sparrows are less likely to nest in isolated sagebrush stands smaller than 5 acres (2 ha) (Knick and Rotenberry 1995).

Habitat on National Forest System lands has remained relatively stable while habitat on private land has declined due fragmentation from conversion to agriculture and housing development

(Holmes and Johnson 2005). Threats to the Brewer's sparrow include: wildland fire, invasion of non-native plants, livestock and wild ungulate grazing and habitat manipulations.

Effects to greater sage-grouse as a result of management actions and direction are anticipated to be similar for sage sparrow.

Columbian sharp-tailed grouse (Tympanuchus phasianellus)

In Region 2 Columbian sharp-tailed grouse are found only in Colorado and Wyoming (Hoffman and Thomas 2007). Sixty-eight percent of the occupied habitat in the region is on private lands with four percent occurring on lands administered by the USFS on the Routt, Medicine Bow and White River National Forests. The birds inhabit the transition zone between the arid sagebrush rangelands and the start of the aspen-conifer forests at elevations of 1,890 to 2,591 m. There are two Columbian sharp-tailed grouse leks and four lek complexes on the RNF; (December 2012 NRM Database) all of these are located in PGH in the analysis area in California and Slater Park areas of the RNF. (A lek complex is a group of several small leks in close proximity that birds appear to move between.)

Columbian sharp-tailed grouse (CSTG) are associated with sagebrush habitat and can even be found in sagebrush that has been sprayed or burned and reseeded with non-native grasses, as long as adequate cover is present. CSTG select habitats mostly based on structural characteristics of the vegetation, but species composition is also important. Lek location depends primarily on the proximity to suitable nesting and brood-rearing cover. Typically, leks are on elevated sites in open areas where the vegetation is short and sparse. Nests with more cover show greater success than nests with less cover (Schroeder and Baydack 2001). Brood habitats provide enough cover from predators and weather while supplying the plant species that chicks and hens need to meet nutritional requirements. Flocks begin forming in the fall, and by winter Columbian sharp-tailed grouse move to riparian zones and patches of mountain shrubs. On the RNF, the primary winter cover is mountain shrub and aspen.

Columbian sharp-tailed grouse are sympatric with greater sage-grouse in ADH on the RNF and threats are similar between the species. The Columbian sharp-tailed grouse is anticipated to respond similarly to the greater sage-grouse as a result of the management guidance proposed across the alternatives.

Sage sparrow (Amphispiza bellii)

The sage-sparrow is a medium sized passerine (song-bird) that breeds in sagebrush-steppe of the intermountain west. According to Holmes and Johnson (2005b), within Region 2, the sage sparrow breeds in portions of western, central, and northwestern Wyoming, and in western and south-central Colorado. There has been documentation of sage sparrows within 10 km of the RNF but none actually on the forest (December 2012 NRM Database). Additionally, the Colorado Breeding Bird Atlas reports possible sage sparrow breeding within several survey blocks that overlap the Forest (Lambeth 1998).

The sage sparrow is a sagebrush obligate that prefers shrublands dominated by big sagebrush (*Artemisia tridentata spp*.) with a perennial bunchgrass understory (Holmes and Johnson 2005b). Landscape level attributes that are positively associated with sage sparrow density include high sagebrush cover, large patch size, spatially similar patches, low disturbance, and little

fragmentation (Knick and Rotenberry 1995). Sage sparrows are ground-foraging omnivores, preying primarily on insects, spiders, seeds, small fruits, and succulent vegetation (Holmes and Johnson 2005b).

Effects to greater sage-grouse as a result of management actions and direction are anticipated to be similar for sage sparrow.

Loggerhead shrike (Lanius ludovicianus)

The loggerhead shrike is a species that frequents open habitats such as grasslands, shrub lands, and agricultural lands. Important habitat requirements include: scattered trees, shrubs, or low bushes for nesting substrate; elevated perches for hunting and courtship activities; foraging areas comprised of open, short vegetation with some relatively bare areas; and thorny trees or barbed wire fences for impaling prey (Pruitt 2000).

The species appears to have suffered substantial population declines from historical levels across its range (USDA 2003b). Wiggins (2005c) suggests that loggerhead shrikes were historically common breeding birds within Region 2, although recent BBS data suggests long-term negative trends in breeding season abundance (BBS data). Within Colorado, loggerhead shrikes have historically been noted as common breeders statewide at lower elevations, but recent information suggests that they have patchy, uncommon distributions in western Colorado and are mostly associated with river valleys (Wiggins 2005c). Several loggerhead shrikes have been documented on the RNF; however, none have been observed in areas with designated sage-grouse habitat (December 2012 NRIS Wildlife database).

Northern harrier (Circus cyaneus)

Most northern harrier nests are found in undisturbed wetlands or grasslands dominated by thick vegetation. They prefer open habitats characterized by tall, dense vegetation. They vegetation in dry or wet grasslands, wetlands, croplands, fallow fields, lightly grazed management units, and brushy areas. Northern harriers forage over open habitats of moderate to heavy cover, and hunt by flying close to the ground and taking small animals by surprise. The diet consists mainly of small mammals, including mice and voles, but they are also known to consume birds and occasionally reptiles and frogs. Northern harriers are a wide ranging species with very large distributions. Some have large ranging seasonal migrations sometimes occurring from North to South America. They are found in Colorado and have been documented in the analysis area (December 2012 NRM Database).

Yellow-billed cuckoo (Coccyzus americanus)

Historically, yellow-billed cuckoos bred across most of North America. Wiggins (2005b), suggested that cuckoos in western Colorado and southwestern Wyoming seem to be disappearing. There are two records of a yellow-billed cuckoo adjacent to the RNF, one from 1998 found during the Colorado Breeding Bird Atlas (Kingery 1998) and also a window strike from 2012 that was in the same general area of the 1998 observation. These records occurred in Routt County on private land.

The yellow-billed cuckoo prefers to nest in open woodlands with an understory of dense vegetation, especially near water. Cuckoo nests are typically placed in dense patches of broad-

leaved deciduous trees, usually within relatively thick understory (Hughes 1999). One researcher in California discovered that there was a positive relationship between patch size and habitat occupancy (Laymon 1998). Yellow-billed cuckoos feed primarily on slow-moving insects.

D. Fish

Mountain sucker (Catostomus platyrhynchus)

In Region 2, the mountain sucker occurs throughout Wyoming and in northwestern Colorado and western South Dakota. Mountain suckers have been documented on the RNF, including along multiple streams in PGH in the California Park area of the Hahns Peak/Bears Ears Ranger District (December 2012 NRIS Wildlife database).

Little information and data exists for the mountain sucker, especially Region 2 populations. They primarily occur in lotic waters, from small montane streams to large rivers (Simpson and Wallace 1982, Page and Burr 1991, Baxter and Stone 1995). Most commonly they are found in smaller headwater streams. They prefer clear, cold creeks and small- to medium-sized rivers.

Threats to mountain suckers include: habitat loss due to stream impoundment, habitat degradation due to sedimentation, construction of passage barriers, such as dams and culverts, and introduction of non-native species causing increased predation and competition (Belica and Nibbelink 2006).

Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus)

The Colorado River cutthroat trout (CRCT) range includes colder headwaters of the Green and Colorado rivers that include the Yampa River drainage in Colorado, Utah, and Wyoming (Young 1995). Recent work by Hirsch et al. (2006) estimates that CRCT occupy 13% and potentially up to 14% of their historical range in the mountainous regions of the Colorado River Basin identified by Benhke (1992).

CRCT have been documented on the RNF (December 2012 NRIS Wildlife database). This includes two sites within the analysis area—along multiple streams in PGH in the California Park area of the Hahns Peak/Bears Ears Ranger District, and along one stream north of Toponas on the Yampa Ranger District. The Yampa River Basin has 53 conservation populations identified in 79 streams or 339 miles of stream and has the third highest number of conservation populations (Upper Green River Basin has 76 populations, ranked 1st and Upper Colorado has 75 populations, ranked 2nd).

CRCT thrive in cold, clean water environments within high elevation streams and lakes that have well-vegetated stream banks for cover and bank stability. The decline of CRCT is attributed to the following threats: replacement by brown, rainbow, and brook trout, hybridization with rainbow trout, over harvest, and habitat fragmentation or alteration from livestock overgrazing, logging, mining, and water diversions (Behnke 1992, Young 1995).

E. Plants

***Astragalus leptaleus* - Park milkvetch**

Park milkvetch is a perennial herb that occurs in sedge-grass meadows, swales and hummocks, wetlands, aspen glades, and streamside willow communities between 6,500 and 9,500 feet. It is known from Idaho, Montana, Wyoming and Colorado. The species is more common in Colorado than in the other states. Threats to Park milkvetch include habitat loss and degradation associated with grazing, trampling, and non-native species invasion (Ladyman 2006a; Spackman et al. 1997). The species is ranked as secure globally but imperiled in Colorado (G4S2). No occurrences of Park milkvetch have been documented in the project area although potential habitat exists. Potentially suitable habitat within the project area occurs in the riparian zones and small moist swales. This habitat is limited in the project area.

***Botrychium lineare* - Narrow-leaved moonwort**

Narrow-leaved moonwort is a very inconspicuous perennial herb that occurs in a wide range of habitats including grass and forb meadows, under trees in woods, on shelves of limestone cliffs, and among riparian transition vegetation associated with aspen. It is sometimes associated with previously disturbed ground. In Colorado it is found at elevations ranging from roughly 7,900 to 11,000 feet. Its distribution extends from Washington and Montana south to California and Colorado. Historic records include Quebec and Nebraska. The species is thought to be globally imperiled and critically imperiled within Colorado (G2?S1). It was previously a candidate for federal listing as an endangered or threatened species (66 FR 30368). Threats include road maintenance and construction, mining, mine reclamation activities, trampling by hikers or ATVs, over-collection, and alteration of soil and hydrological regimes (Beatty et al. 2003a).

***Botrychium paradoxum* - paradox moonwort**

Paradox moonwort is a perennial herb that inhabits mesic to wet subalpine meadows. Its distribution extends from southwestern Canada to Montana, Idaho, and Utah. Populations are small and widely scattered. Paradox moonwort is ranked G2, and S1 in Idaho and Utah. Montana ranks the species S2. This rank indicates that the species is considered imperiled to vulnerable globally and in Montana, and is critically imperiled in Idaho and Utah, but it is not currently ranked in Colorado. This plant is small, easily over-looked, and may not produce above-ground structures every year. Threats to the species are similar to those faced by *Botrychium lineare* and include maintenance and construction, mining, mine reclamation activities, trampling by hikers or ATVs, over-collection, and alteration of soil and hydrological regimes.

***Carex diandra* - lesser panicled sedge**

Lesser panicled sedge grows in wet meadows and willow carrs. Its distribution spans the northern half of the United States, but reaches its southernmost Rocky Mountain distribution in Colorado. It is known from Boulder, Grand, Jackson, and Larimer counties at elevations ranging from 7,000–9,000 feet. The species is globally secure (ranked G5), but considered critically imperiled in the state of Colorado (ranked S1). Threats to the species and its habitat include hydrological alteration, timber harvest activities, fire, roads and trails, off-road vehicle use, use, peat extraction, livestock, recreation, exotic species, atmospheric deposition of pollution, and climate change (Gage and Cooper 2006a)

***Cypripedium parviflorum* – Lesser yellow lady's-slipper**

Yellow lady's-slipper is a perennial orchid. It occurs in a variety of shaded, moist habitats, including aspen forests, white spruce/paper birch, paper birch/hazelnut, and ponderosa pine/Douglas fir forests, in rich humus and decaying leaf litter in wooded areas, rocky wooded hillsides on north- or east-facing slopes, on wooded loess river bluffs, and moist creek sides (Mergen 2006; Spackman, et al. 1997). Although widespread, it is uncommon in most of its range. Populations are widely scattered in Colorado where the species is known from ten counties at a narrow elevation range of 7,400 to 8,500 feet. Although the species is considered secure globally it is considered imperiled in Colorado (G5/S2). Threats include habitat alteration (including conifer encroachment), overstory modification, and changes in soil and hydrological regimes, land management activities, unauthorized recreation, and over-collection (Mergen 2006). The species is believed to be in decline due to habitat loss associated with residential development on private lands, over-collection, grazing, and logging (Mergen 2006). Potentially suitable habitat within the project area occurs in the riparian zones and small moist swales.

***Eleocharis elliptica* – elliptic spikerush**

Elliptic spikerush is a perennial, mat-forming wetland species. In Colorado, it occurs in piedmont valleys, outwash mesas, and wet places in pine forests (Nellessen 2006). Primary threats include hydrologic changes (including water chemistry), grazing, non-native species and climate change. It is ranked as globally secure, but critically imperiled in Wyoming (S1). It is not ranked in Colorado. Potentially suitable habitat in the project area occurs in the riparian zones and small moist swales. No population trend data are available (Nellessen 2006).

***Eriogonum exilifolium* - Dropleaf buckwheat**

Dropleaf buckwheat is a perennial herb that grows in sparsely vegetated habitats such as barren hills or sagebrush flats of the mountain parks. It is a regional endemic known only from 26 occurrences in Wyoming and Colorado although it may be locally abundant. In Colorado the plant has been found in North Park and Middle Park of Jackson and Grand counties at elevations ranging from 7,500–9,000 feet. Global ranking for the species is G3(vulnerable to extinction), and state ranking is S2 (imperiled). Threats include "*residential and commercial development, range improvements, off-road vehicle use, other recreational uses, grazing, energy development, reservoir creation, right-of-way management, coal mining, exotic species invasion, effects of small population size, disease, declining pollinators, fire, global climate change, and pollution*" (Anderson 2006a). It is possible population numbers are decreasing as a result of these threats, but the magnitude of these impacts is unknown. On the RNF habitat for this species occurs at lower elevations near the boundaries where sagebrush is present.

***Eriophorum gracile* - slender cottongrass**

Slender cottongrass is a perennial sedge that grows in montane and subalpine wetlands as well as wet meadows and pond edges. Distribution extends Alaska, Canada and the northern states south to California and Colorado. It reaches its southernmost Rocky Mountain distribution in Colorado where it is known from elevations of 8,100–12,000 feet. The known sites are widely scattered in Jackson, Las Animas and Park counties. The species is ranked secure globally (G5) but imperiled in Colorado (S2). In Region 2, slender cottongrass appears to be on a downward trend, as eight of the Region's 36 known sites have apparently been extirpated (Decker, Culver

& Anderson 2006). Potentially suitable habitat within the project area occurs, but is extremely limited.

***Ipomopsis aggregata* ssp. *weberi* – Weber's Scarlet gilia**

Weber's scarlet gilia is a perennial forb that grows in coarse-textured rocky or gravelly soils of open sites in montane shrub communities or coniferous forest. The subspecies is endemic to northern Colorado and southern Wyoming, Most populations occur around Rabbit Ears Pass near Steamboat Springs, Colorado. Although the species is secure globally (G5, *Ipomopsis aggregata* is a common species), the subspecies *weberi* is imperiled globally and at the state level (Ladyman 2004). Threats include recreational activities, residential development, road construction, grazing (by both livestock and native ungulates), and invasive species. Stochastic events may also be a threat due to small population size. Most populations have not been monitored since their discovery, so trend data are unavailable.

***Machaeranthera coloradoensis* - Colorado tansy-aster**

Colorado tansy-aster is a perennial herb that inhabits mountain parks, slopes, rock outcrops and dry tundra at elevations ranging from 8,500 to 12,500 feet. The species is found only in Wyoming and Colorado. The species is considered imperiled both globally (G2) and in Colorado (S2). Because no quantitative repeat monitoring has been performed and population trend cannot be determined, but several Colorado botanists have expressed an opinion that the plants population trend is stable and that additional populations remain to be discovered (Beatty et al. 2004).

***Malaxis brachypoda* – White adder's-mouth orchid**

White adder's mouth orchid *(Malaxis brachypoda)* occurs in mossy wet areas, shaded riparian areas, and riparian transition zones. It is disjunct and extremely rare in Region 2; nearest occurrences to those in Colorado are in southern California and northern Minnesota (Anderson 2006b). In Colorado it is found at elevations between 7000 and 9080 ft. Globally, there is concern for its long-term viability (ranked G4Q), and it is considered critically imperiled (S1) in Colorado. *Malaxis brachypoda* has endangered, threatened, or other status in ten U.S. states and one Canadian province. Population trend data is unknown, however extirpation of many of the historic populations suggest the species is declining (Anderson 2006b).

***Mimulus gemmiparus* - Weber's (Rocky Mountain) monkeyflower**

Weber's monkeyflower is an annual herb found in granitic seeps, slopes, and alluvium in open sites within spruce-fir and aspen forests at 8,500 to 10,500 feet. The species is endemic to the mountains of central and northern Colorado. The plant is considered critically imperiled both globally and in Colorado (ranked G1S1). The primary threat to *Mimulus gemmiparus* is the small size of populations; a single disturbance event could feasibly extirpate an occurrence. Activities that could impact an occurrence include recreation, invasion by non-native plant species, trail and road construction and maintenance, wildfires, and forest management activities such as logging, thinning, or prescribed fires (Beatty et al. 2003b). Population trend for this species is unknown.

***Penstemon harringtonii* - Harrington beardtongue**

Harrington beardtongue is a perennial herb endemic to Colorado. It is known primarily from sagebrush slopes at elevations from 6,400 to over 9,400 feet in Eagle, Garfield, Grand, Pitkin, Routt, and Summit counties. The species is ranked G3S3, indicating vulnerability throughout its range. Threats to the species include habitat loss due to agricultural conversion or residential development, motorized recreation, invasion by non-native plant species, grazing by domestic livestock and native ungulates, oil and gas development, and climate change (Spackman-Panjabi and Anderson 2006). Cumulative impacts of these threats may be causing the populations to decline (Spackman-Panjabi and Anderson 2006) but the magnitude of the decline is unknown. Small stands of sagebrush at the lower elevation Forest boundaries are the primary potential habitat.

***Potentilla rupincola* – rock cinquefoil**

Rock cinqfoil is an herbaceous species that occurs in granite outcrops at elevations between 6,500 feet and 10,900 feet. It is considered imperiled at both global (G2) and state (S2) levels. Threats include exotic species invasion, residential and commercial development, indirect effects of grazing, off-road and recreational vehicle use, small population size, climate change and pollution (Anderson 2004).

***Rubus arcticus* var. *acaulis* - dwarf raspberry**

Dwarf raspberry is an herbaceous wetland species found in willow carrs and on mossy streamsides at elevations ranging from 8,600 to 9,700 feet. Associated species include include shrubby cinquefoil, dwarf birch, diamondleaf willow, water sedge, and alpine meadow-rue. Distribution is circumboreal, ranging south in North America to Oregon, Colorado, Michigan, and Maine. Dwarf raspberry is ranked G5T5 indicating that the species and subspecies are secure globally, but the species is ranked S1 (critically imperiled) in both Colorado and Wyoming. Threats include habitat loss resulting from recreational activities, livestock grazing, and extraction of natural resources such as timber and peat. Activities such as water diversions or impoundment that reduce water availability and change habitat quality are also a threat. Other threats include recreation, forest management activities, invasion by non-native plant species, and climate change. Finally, in Region 2 dwarf raspberry occurs in small and disjunct populations, leaving them vulnerable to stochastic events. The current population trend is unknown, but Ladyman (2006b) notes that several extirpation events appear to have taken place; the species is now absent from the British Isles and Latvia, and it is now Endangered in Estonia. Clearly, the species is vulnerable to extirpation, particularly in areas such as Region 2 where it is on the edge of its range and less common.

***Salix candida* - sageleaf willow (hoary willow)**

Sageleaf willow is found in pond and stream edges as well as in fens of the foothill and montane wetlands. Distribution spans the northern third of the western hemisphere, with the southernmost extent in Colorado. In Colorado, it is found from 8,800-10,600 ft. in Gunnison, Hinsdale, La Plata, Lake, Larimer, and Park counties. Although sageleaf willow is considered secure globally (ranked G5), it is ranked critically imperiled (S1) in Colorado. Population trends are unknown (Decker 2006a). Seven populations (one historic) are known from the Medicine Bow National Forest but none are known from the RNF.

***Salix serissima* - Autumn willow**

Autumn willow is a woody shrub of the willow family (Salicaceae) that grows in wetland areas including marshes, fens, and bogs. The species ranges from Canada to the northern U.S. In the Rocky Mountains it is found in Montana, Wyoming, and Colorado. In Colorado, where the species reaches its southernmost distribution, autumn willow is known from Custer, Park, Larimer, and Routt counties at elevation ranging from 7,800-10,200 feet. It is apparently secure globally (G4), but it is critically imperiled in Colorado (S1). Population trend data for this species are lacking (Decker 2006b).

***Selaginella selaginoides* - club spikemoss (northern spikemoss)**

Club spikemoss is a herbaceous, mat-forming perennial that grows in marshy areas and wet spruce forests and produces spores during July and August. Distribution is circumboreal with the southern extent in the United States. It is known to occur in Wyoming, but reports of occurrences in Colorado could not be substantiated (Heidel and Handley 2006). The species is difficult to identify in the field and this may contribute to the lack of information on the species' distribution. Club spikemoss is ranked G5. In Wyoming the species is considered critically imperiled (S1). In Colorado it is ranged as SRF (indicating a false report). Threats include hydrologic changes, grazing, timber harvest, invasive species and climate warming. Although population trend data are lacking, some populations have been extirpated and the species is vulnerable to decline (Heidel and Handley 2006).

***Triteleia grandiflora* - largeflowered triteleia**

Largeflower triteleia is a perennial forb of the Lily family (Liliaceae). Distribution of this species centers around the Pacific Northwest, with populations in Colorado (San Juan NF) and Wyoming (Medicine Bow NF) representing the southern- and eastern-most extents. In Colorado, the species is found in openings among *Pinus ponderosa* (ponderosa pine) and *Quercus gambelii* (Gambel oak) at approximately 7,800 feet. *Triteleia grandiflora* is considered globally secure (ranked G4) but critically imperiled (S1) in Colorado. Threats include habitat loss, fragmentation, and degradation caused by human recreation, livestock grazing, resource development (timber and mineral), and invasive non-native plant species are potential threats to the long-term persistence of *Triteleia grandiflora* throughout its range, including Region 2. Long term monitoring data are needed to determine population trends for this species, but Ladyman (2007) notes that several populations have been extirpated and extant populations appear to be declining.

***Utricularia minor* - lesser bladderwort**

Lesser bladderwort is an aquatic perennial herb that can occasionally become "beached" when water levels drop. The plants are insectivorous with bladders acting as tiny insect traps. Although distribution is circumboreal, populations are very infrequent. In Colorado, the species is known from shallow water in subalpine ponds at 5,500-9,000 ft. There are two known populations on the Routt NF, but neither occurs in the project area. Although the species is considered globally secure (G5), is considered imperiled to critically imperiled (S2) in Colorado. Threats include hydrologic impacts (water quality degradation, alteration of hydrologic regime), habitat loss and invasive species (Neid 2006). Population trend data are lacking.

***Viola selkirkii* - great-spurred violet**

Great-spurred violet is a perennial herb that inhabits cold mountain aspen forests, moist woods, and thickets. Although species distribution is circumboreal, it occurs only is small, disjunct populations (Hornbeck et al. 2003). In Colorado is known from 8,500-9,100 feet elevation. The species is considered secure globally, although there is some uncertainty about the ranking (G5). In Colorado is critically imperiled (ranked S1). Threats to the species include recreation, invasion by non-native plant species, wildlife and livestock grazing and trampling, road and trail construction and maintenance, forest management activities, climate change, and stochastic events. Population trend data are lacking.

VIII. SUMMARY OF ANTICIPATED EFFECTS TO SENSITIVE SPECIES

We addressed the potential impacts of each alternative on sensitive species and their habitats that may be present in the analysis area in terms of the following resource areas: recreation and travel management, lands and realty, range management including grazing, energy and mineral development, and fire/fuels management and habitat restoration. These resource practices are tied to potential threats previously identified in Table 8. Each of the action alternatives, to various degrees, could cause very minor negative effects; however, given that the analysis area covers such a small portion of the RNF (~1%), most of the effects from the action alternatives to populations of sensitive species across the RNF are very minor or negligible in nature. For example the differences between the no action (no change in current direction) alternative and all of the action alternatives, is that the action alternatives would put into place some level of regulatory authority and direction to protect and conserve GRSG habitats and minimize negative effects associated with land management actions in the resource areas above. Largely the action alternatives provide beneficial effects and assurances, which over time should provide small improvements for each of the species evaluated.

Under the Alternative A, current management actions would continue as prescribed in the RNF LRMP. There will likely be some beneficial consequences from the action alternatives based on the fact there will be fewer anthropogenic disturbances with regard to road construction and maintenance, energy and mineral development, ROW development, fuels management, as well as, grazing effects. Under Alternative C, grazing would be terminated in ADH. This would create small pockets of improved habitat conditions for sensitive animal species. This would also remove the direct and indirect effects of resulting from domestic livestock. Alternatives B and D would also minimize effects due to grazing, but instead of removing livestock would attempt to change season of use, duration, locations, etc. Alternative D provides a more measured approach to effects by qualifying any potential management action by ensuring it improves conditions for GRSG and their habitats. Differences in negative effects between action alternatives would be negligible and differences in positive effects would be difficult to discern particularly for sensitive animal species that utilize habitats broader than ADH.

A. Effects of Alternative A to Sensitive Animal Species including the GRSG

Recreation and Travel

Under this alternative there would be no changes to the current National Forest System roads, transportation plan, or recreation management on the Forest. Therefore conditions would remain

the same. Less restrictive travel conditions in GRSG habitats create the potential for increased negative effects. For GRSG and other sage brush obligate birds this can include disruption of nesting activities, abandonment of young and/or temporary displacement.

Any direct negative effects currently experienced by sensitive animal species allowed with current management direction recreation and travel management, such as siltation/sedimentation of ponds, wetlands, or streams, due to motor vehicle use, and general disturbance to sensitive species by humans from recreational activities would continue. Conversely, existing efforts and opportunities through travel management and recreation planning to reduce impacts to protect sensitive animal species and their habitats would continue within the current management direction framework.

Motorized travel would continue to contribute to minor degradation of aquatic habitat. The condition of fish and amphibian populations and aquatic habitats across designated habitat would remain stable, reflecting the effects of all past and current management activities.

Sensitive animal species may see the potential for greater negative impacts with Alternative A compared to other alternatives due to the reduced level of management direction restrictions on activities that cause these effects. For sensitive species utilizing a broader range of habitats on the RNF, changes in management direction are likely to be insignificant.

The cumulative effects from existing activities would generally result in maintaining the current conditions to sensitive animal habitats and populations.

Please refer to the recreation and travel sections of the DEIS for additional information.

Lands and Realty

USFS lands on the RNF would continue to be managed according to FS policy, regulation and existing plan direction. Permitted ROWs would continue to produce construction, maintenance, and operation activities based on the existing guidance in the Forest Plan. This may result in greater habitat loss, fragmentation, temporary increases in road use, potential sedimentation or degradation of habitats for sensitive animal species compared to an action alternative that has added direction in GRSG habitat areas for management related to lands and realty.

Under this alternative, there would be no changes to the current approach associated with exchange, acquisition, or disposal of lands or with permitting ROWs on Forest Service lands. Though most proposed projects would strive to mitigate or minimize impacts, this alternative would likely have the greatest potential for impact on sensitive animal species. Alternative A has a greater potential for negative effects, than an alternative with additional management direction, although this would likely be negligible to sensitive animal species that utilize a broader range of habitats on the RNT.

Please refer to the lands and realty section of the DEIS for additional information.

Range

Under this alternative, there would be no change in the numbers, timing, or method of livestock grazing on the Forest from the existing Forest Plan. In addition, there would be no change to wild horse or burro management, which is not a current issue on the RNF.

Under the current management regime, sensitive animal species including GRSG, amphibians, fish and other birds would be managed based on existing plan direction. Implementation of range decisions with existing plan direction has been determined to result in impacts to sensitive animal species. It is likely that these impacts may be reduced with an action alternative in sage-grouse habitats with the addition of additional management direction. Alternative A has a greater potential for negative effects, than an alternative with additional management direction, although this would likely be negligible to sensitive animal species that utilize a broader range of habitats on the RNT.

Please refer to the Range section of the DEIS for additional information.

Energy and Minerals

Energy and mineral development is not a major use on the RNF and is not a current threat in GRSG habitat for areas affected by the DEIS. Currently none of the PPH on RNF is leased. There has been a dramatic increase of energy development on adjacent private and BLM lands and although a current non-issue on the RNF, this could change in the next several years.

Under this alternative, the existing energy and mineral development direction would remain the same. This direction is somewhat dated and does not reflect the more current approaches to energy development that are being utilized. Existing stipulations are limited to timing in most grouse habitat areas. A small percentage of PPH would remain closed to non-energy leasable mineral leasing, with the majority or remainder of all designated habitats open to leasing (including expansion of new leases) with no cap on surface disturbing activities. As such, this alternative would be expected to have the potential for the greatest amount of direct and indirect habitat loss, degradation, and fragmentation for sensitive animal species and their habitats.

Though there are conservation measures and best management practices in place to minimize effects, the potential effects from development would be greater in Alternative A, since more areas would be available and with less restrictive stipulations.

Please refer to the energy and mineral section of the DEIS for additional and more detailed information on effects of Alternative A

Fire and Fuels Management

Alternative A would have the fewest restrictions for fuels management actions in areas with GRSG habitat which could result in a higher potential for vegetation impacts in the sage brush type. As this alternative does not prioritize fire operations beyond what has already been determined in the Fire Management Plans for the area, potential impacts may include the potential for increased loss of sage brush habitat due to current direction for fuels management. A lack of additional management direction for fuels management in sagebrush, is likely to result in a greater potential for impacts to animal species that utilize sagebrush habitats, including the GRSG.

Please refer to the Fire and Fuels Management section of the DEIS for additional information and more detailed information on effects of Alternative A.

B. Effects of Alternative B to Sensitive Animal Species including the GRSG

Recreation and Travel

Under this alternative there would be limited opportunities for road construction in PPH, with minimum standards applied and no upgrading of current roads. In addition, recreational use permits would only be given in PPH if there was a neutral or beneficial impact to GRSG.

Sensitive animal species that utilize PPH areas, would improve relative to effects of Alternative A. These impacts would be positive in nature and would include: limited road construction resulting in less use, road density, recreational disturbance, opportunities for collisions, and reduced indirect impacts to adjacent areas from sedimentation to wetland systems. Therefore sensitive animal species utilizing these areas are likely to benefit from added management direction in Alternative B, compared to Alternative A. Since only a very small portion of the RNF is considered PPH, the effects would likely be minor to negligible, but any management direction leading to conservation would be a positive effect

Please refer to the Recreation and Travel section of the DEIS for additional information and more detailed information on the effects of Alternative B.

Lands and Realty

Under this alternative, PPH would be managed as an exclusion area and general habitat would be managed as an avoidance area for new rights-of-way projects. In addition, Alternative B would encourage the retention, acquisition and consolidation of sage-grouse habitat areas, facilitating conservation for GRSG and other species that depend on sage brush ecosystem. The RNF would keep and work to acquire PPH. This would result in little to no degradation, fragmentation, and loss of sensitive species habitat in GRSG PPH, but this restriction may shift land and realty project focus to GRSG designated PGH or other non-grouse habitat types. In non-PPH areas, permitted ROWs would likely have similar effects to those addressed in Alternative A. These conservation measures would be more protective than conservation measures in Alternatives A and D, but less protective than Alternative C. This represents a concerted effort to maximize connectivity and minimize fragmentation of sagebrush habitats, thus indirectly benefiting other sensitive species that utilize these habitats.

Please refer to the Lands and Realty section of the DEIS for additional information and more detailed information on the effects of Alternative B.

Range

Alternative B would adjust grazing direction in GRSG PPH, this is less than 1% of the land cover of the RNF. The potential effects due to livestock grazing, vegetation disturbance, and range improvements is expected to be very similar same under Alternative B, as it would be under Alternative A, except that would be a few more restrictions go grazing in PPH, thus benefiting sensitive animal species that utilize these habitat types. These adjustments: timing, stocking rates, and residual cover would likely provide a minor, but positive effect on habitat effectiveness and decrease likelihood for trampling and disturbance for sensitive animal species utilizing areas within PPH.

None of the sensitive amphibian species are known to occur in these areas, there would likely be no change to sensitive amphibian species from alternative B. This includes a very small proportion of the southern site in the analysis area where CRCT are known to occur. Mountain sucker are not found in the PPH on the RNF. Even in the area where CRCT do occur, there would be no direct negative effects to the species from alternative B. The indirect effects from decreasing grazing pressure on such a small part of the RNF could lead to small habitat improvements for populations of CRCT further downstream by decreasing the amount of sediment deposited in waterways; however, these improvements would likely be so small as to not be measurable.

The indirect effects from decreasing grazing pressure on such a small part of the RNF could lead to localized habitat improvements; however, these improvements would likely be considered insignificant to sensitive species at the forest scale, particularly for those species that utilize a broader range of habitat types. Cumulative effects are anticipated to be similar as with the no-action alternative.

Please refer to the Rangeland management related section of the DEIS for additional information and more detailed information on the effects of Alternative B.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks. Presumably, the above protective measures would be expected to benefit those other sensitive animal species whose ranges or habitat are coincident with GRSG PPH. This restriction could create impacts in other adjacent habitat types if there was interest in energy or mineral development under the NSO. Direct impacts to wildlife habitats from construction and operation of energy and/or mineral facilities would be similar to impact for ROWs and could include direct habitat loss, fragmentation and degradation.

Though currently there are no known active GRSG leks and very little PPH on the RNF, this alternative would provide protection now and into the future for the most important GRSG habitats, thereby improving conditions for sensitive species that utilize areas mapped as PPH (Brewer's sparrow, Columbian sharp-tailed grouse & sage sparrow). There would likely be very minor indirect benefits to fish from protecting PPH. This alternative may shift energy and mineral development to less desirable sagebrush or non-sagebrush habitat, there may be lingering effects of not protecting all sagebrush or ADH. This alternative would minimize or eliminate the likelihood for impacts sensitive animal species utilizing PPH on 1,968 acres (delineated PPH).

Please refer to the energy and minerals related section of the DEIS for additional information and more detailed information on the effects of Alternative B.

Fire and Fuels Management

Sage-grouse habitat, specifically PPH would have additional management direction designed to promote the protection of PPH from wildfire and ensure that effects from fuels management are accomplished in a manner that benefits or does not impact GRSG. This alternative would help

reduce the localized threats to PPH from fire, compared to Alternative A. This would be a benefit to sensitive animal species that utilize PPH habitats.

Please refer to the fire and fuels management related sections of the DEIS for additional information and more detailed information on the effects of Alternative B.

C. Effects of Alternative C to Sensitive Animal Species including the GRSG

Recreation and Travel

Under this alternative, road and trail construction would be limited in all designated habitat, and no new roads would be constructed within 4 miles of a lek or occupied habitat. Under this alternative, effects would be similar to those mentioned in Alternative B, except that it would apply to ADH and not just PPH. This is the most restrictive alternative for recreation and travel.

There would be very few if any negative effects from this alternative to sensitive species occurring in ADV as a result of recreation or travel related projects. Any amphibians within any of the delineated area mentioned above would largely be protected and the impacts would likely be positive in nature, such as: reduced siltation/sedimentation of ponds, wetlands, or streams, slightly improved and likely largely undisturbed breeding and foraging habitat, and less disruption of normal life history activities by humans. Therefore current population trends would stabilize or slightly improve over time.

Please refer to the recreation and travel management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

Lands and Realty

Under this alternative, all designated habitat would be exclusion areas for ROWs and special use permits. The RNF would keep and seek to acquire GRSG ADH where interest and opportunities exist. This would result in little to no degradation, fragmentation, and loss of sensitive wildlife habitat in all areas of ADH. Therefore this would have the most protective measures thus benefiting sensitive animal species that utilize these areas.

Alternative C would have the most protective measures for all sage-grouse habitat. In this alternative, ADH would be managed as an exclusion area for new ROW projects. In addition, Alternative C would encourage consolidation of sage-grouse habitats, facilitating habitat conservation and management. This alternative would be expected to have the least negative impacts and most positive impacts to wildlife species whose ranges overlap with PGH and PPH.

Maintaining continuous diverse sagebrush habitats would likely maintain good watershed and runoff patterns that sustain health of the land and the streams that bear fish.

Please refer to the lands and realty management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

Range

This alternative would eliminate grazing in ADH. This accounts for approximately 1% of the land cover of the RNF. If grazing was removed in these areas, there would be reductions of impacts that result from livestock grazing. The direct effects of changes to vegetation condition

due to grazing and the potential for trampling of individuals, nests and or chicks, as well as the indirect effects of erosion and sedimentation caused by domestic livestock would be removed. Wild ungulates would still create some of these types of impacts, though to a lesser degree due to lower concentrations.

This management action would result in greater vegetation cover improving hiding cover and habitat quality for GRSG and sage-brush associated species. Palatable forbs may increase allowing increases in insects, which is an important protein source for GRSG chicks during brood rearing.

The positive effects of Alternative C on fish and amphibians, would be even more pronounced than those described in Alternative B, because all grazing would be terminated in ADH. Though this only accounts for 1% of the land cover of the RNF, effects to fish downstream of these areas could be ameliorated by no cattle grazing in, near, and around riparian areas and streams within ADH. There would likely be no negative effects to fish by removing cattle from the system, but substantial positive impacts of reduced sedimentation and turbidity, as well as overall riparian vegetative health and water quality. Under this alternative and based upon potential positive impacts of removing grazing, Colorado River cutthroat trout may increase in population trends because of this species' limited distribution on the RNF.

There would be few if any negative effects on sensitive animal species due to implementation of alternative C with respect to range resources, however the potential for fire may increase due to increases in fine fuels.

Please refer to the rangeland management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

Energy and Minerals

Under this alternative, all designated habitat would be closed to new fluid mineral leases, and existing leases would have a 4 mile no surface occupancy buffer around leks. Presumably, the protective measures would benefit those sensitive species whose ranges or habitat are coincident with all designated sage-grouse habitat or the buffer. Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Please refer to the energy and mineral management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

Fire and Fuels Management

Alternative C would aim to protect and restore sagebrush habitats in all designated sage-grouse habitat using native seed post fire, with all burned areas closed to grazing post wildfire. Any reduction in wildfire near and around sagebrush habitats would likely benefit GRSG and other sensitive species in the short term. Alternative C extends management direction throughout ADH, as opposed to just priority habitat in Alternative B, thus increasing the potential for retaining larger areas of sagebrush ecosystem in a condition more suitable for GRSG, This may improve opportunities for population expansion in the future. Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Please refer to the fire and fuels management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

D. Effects of Alternative D to Sensitive Animal Species including the GRSG

Recreation and Travel

Under this alternative, the effects of most suggested management actions would be similar to Alternative B, with the exception that more flexibility or discretion would be given to the land management agency to allow route construction in PPH, road improvements, and issuance of SRPs if it is determined that these actions would not adversely affect GRSG. The exceptions to this would be that any new roads could be constructed to the highest standard and it would allow upgrading roads based on no adverse effect to GRSG. Under this alternative if populations and habitats are healthy or improving, it could permit disturbance above the 5% cap of disturbance for the CO management zone. Effects of this alternative allow for greater disturbance to sensitive species habitat compared to alternatives B or C, although distinctions are very minor and overall effects to recreation and travel are very among the action alternatives, and likely insignificant on the RNF due to the limited designated GRSG habitat.

Please refer to the recreation and travel management related sections of the DEIS for additional information and more detailed information on the effects of Alternative D.

Lands and Realty

This alternative is very similar to Alternative B with the major differences being no ROWs would be permitted in PPH and the RNF would keep and seek to acquire lands in PPH where interest and opportunity may enable acquisition. This would result in the potential for minimal impacts from lands and realty management in PPH, but could shift impacts to PGH or other habitat types. In non-PPH areas, permitted ROWs would likely have similar effects to those addressed in Alternative A.

Under Alternative D, PPH would be managed as an avoidance area, however, new ROW projects would be allowed in designated corridors. ROWs would also be allowed in PPH if the project would not adversely affect GRSG populations. This alternative would be more protective than Alternative A, but less protective than Alternatives B and C for sensitive animal species utilizing GRSG habitats. However, due to the amount of habitat on RNF the effects would be similar to Alternatives B and C.

Please refer to the lands and realty management related sections of the DEIS for additional information and more detailed information on the effects of Alternative D.

Range

Alternative D would be similar to Alternative B, but would be slightly more restrictive as GRSG habitat objectives within grazing allotments would be applied to ADH and not just PPH. This alternative would have more management direction than Alternative A & B resulting in a benefit to sensitive animal species, but this benefit would be less that that realized with Alternative C. Generally speaking, if GRSG habitat is taken into consideration before applying the management

action, then GRSG along with other sensitive animal species would likely benefit from that protection or management action.

Please refer to the rangeland management related sections of the DEIS for additional information and more detailed information on the effects of Alternative D.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks similar to Alternative B. However with some mineral development, this alternative would allow up to 5% disturbance in any Colorado Management Zone. Direct effects would be similar to those associated with Alternative B. There could potentially be a few more impacts if the disturbance allowance is increased from 3% to 5%. Therefore effects would be similar to those described under Alternative B and mostly positive.

Please refer to the energy and mineral management related sections of the DEIS for additional information and more detailed information on the effects of Alternative D.

Fire and Fuels Management

Alternative D is generally the same as Alternative B and much of Alternative C except that it extends almost all the same protections across all ADH, not just PPH. This alternative would be the most restrictive for fire and fuels management, and therefore the most protective for sensitive animal species of all the alternatives. This alternative would help reduce the localized threats to ADH from fire, compared to Alternative A. This would be a benefit to sensitive animal species that utilize ADH habitats.

Please refer to the fire and fuels management related sections of the DEIS for additional information and more detailed information on the effects of Alternative C.

E. Effects of Alternative A to Sensitive Plant Species

Direct Effects to All Plant Species Evaluated

Undo-action alternative, current management actions would continue unchanged. The condition of terrestrial and aquatic plant populations in sage-grouse designated habitat would remain stable, reflecting the effects of all past and current management activities. Direct effects to all plant species (except Utricularia minor, an aquatic species) under the current management regime include trampling (by livestock, wildlife, motor vehicles, and/or foot traffic) and grazing. These impacts can physically damage individuals, populations, and/or the habitat where they grow. This may reduce growth, development and/or seed set. Such impacts may also cause mortality of individuals. These impacts to individual plants can reduce population size, change metapopulation structure, and potentially affect viability of the species on the planning unit or across the species' range.

The effects of grazing and trampling impacts on individuals, populations, and habitat quality depend on species biology (e.g., response to herbivory and tolerance of trampling), type of grazer (e.g., cattle, deer, elk, sheep), timing of grazing (e.g., season), grazing intensity (e.g., stocking

density), habitat type (e.g., meadow or forest), and site conditions (e.g., topography, moisture, invasive plants) (Beatty et al. 2003a).

Several studies on Botrychium species have found that the loss of aboveground biomass either through herbivory, fire, or plant collection seems to have no effect on the subsequent return of the plant the following year (Beatty et al. 2003a). Because nutrition may be supplied through interactions with mycorrhizal fungi, moonwort individuals may be more tolerant of removal of leaf tissue by herbivores. Removing the current year's growth may not affect future years' growth, unless the primordial is damaged or significant energy cannot be reclaimed by the plant.

Moonworts typically emerge and develop sporangia (the reproductive portion of the plant) from July through August, when the allotment is in use. Consumption and/or trampling may interrupt reproductive cycles, potentially causing loss of the year's contribution to the seed bank, loss of contribution to root starch reserves needed to survive the winter, and disruption of seedling establishment. Activities that cause repeated removal of the spores, e.g., by grazing or other activities, could cause a moonwort population to decline to the point of extinction (Vizgirdas 2001).

Chadde and Kudray (2003) suggest Botrychium species are more likely to be damaged by incidental trampling than by grazing, because of their small size. Since these plants are small and delicate, any soil or ground disturbance that directly affects growing plants is likely to cause damage, at least to the above-ground structures.

Timing of grazing may also result in direct effects to individuals and populations, but the nature of these effects varies. Some species are thought to 'overcompensate' for lost biomass through production of additional seed-bearing stems, but effects to any given species are not always definitive. For example, early season grazing of Ipomopsis aggregata may (Paige, 1992; Paige & Whitham 1987) or may not (Ladyman 2004; Bergelson & Crawley 1992) lead to overcompensation in the form of increased seed production. Grazing can also delay plant phenology (Bergelson & Crawley 1992) and late season grazing of Ipomopsis aggregata consistently reduces performance of attacked plants (Bergelson & Crawley 1992).

<u>Indirect Effects to All Plant Species Evaluated</u>

Indirect effects of current management include increased erosion and sedimentation (resulting from hoof action, motor vehicles, etc), introduction and/or spread of invasive species. These indirect effects can lead to habitat degradation that ultimately displaces individuals and/or populations of plant species.

Despite designs to avoid livestock concentration, livestock grazing can result in moderate to intense localized ground disturbance. While detrimental to most species, this may be beneficial to others. For example, Botrychium are mostly found in previously disturbed areas.

Invasive species often occur where habitats are disturbed. Some invasive species can be introduced and spread by Forest management activities including livestock grazing. Invasive species can also alter composition of native plant communities, oft.en displacing native plant species (Olson 1999). Changes in plant community composition can alter animal use patterns (Olson 1999). If commmunity composition shifts to undesireable, unpalatable, or toxic species, animals are likely to avoid or abandon the area (Olson 1999, Zouhar 2003) which may increase

grazing pressure on other communities. Invasive species presence can be additive to other disturbances and can change mycorrhizal communities (With 2002).

Ungulate grazing and browsing pressure has substantial effects on vegetation dynamics (Randall and Walters 2011). By altering vegetation composition, the proposed activities may modify forage condition and quality, thus leading wild and domestic ungulates to change their foraging patterns.

Soil compaction could occur where any activities are concentrated (for example, mining activities, recreation activities, livestock grazing). The negative effects of soil compaction have been documented by numerous authors and studies (Cochran and Brock 1985, Daddow and Warrington 1983, Helms et al. 1986). These effects occur when forces exerted on the soil (such as from the weight of machinery or livestock) reduce pore space, particularly macro pore spaces that provide for air and water movement through soils (Adams and Froehlich 1981). Activities that compact soils and reduce pore space can affect both soil micro-organisms and plants themselves.

Cumulative Effects to All Plant Species Evaluated

Fire (planned and unplanned ignitions): Effects of fires vary by species and habitat. For example, low-severity fire may benefit *Botrychium* habitat by reducing the litter accumulation and competition from other plants (Beatty *et al*. 2003). Conifer mortality from the mountain pine beetle epidemic may lead to prescribed burning treatments in the analysis area. This would generally result in an improvement of potential slender moonwort habitat within the analysis area. However, high-severity fires, whether wild or prescribed, that create high ground temperatures could sterilize the soil and eliminate mycorrhizal fungal species that are necessary for *Botrychium* survival.

Invasive Species Control: Within the analysis area, populations of invasive species, such as Canada thistle exist. Ground disturbance creates habitat for these species and the propagules are easily spread by wind and/or by traffic (vehicles, animals, people, livestock, etc.). Invasive species presence can be additive to other disturbances and can change mycorrhizal communities (With 2002) that are essential in for many native species.

Road and Trail Development: Portions of the analysis area are popular recreation areas for fishing, hunting and OHV use on the RNF. Use of these trails can trample plants and introduce and/or spread non-native (invasive) species.

Water Diversions and Developments: Water development or diversion may affect individuals or populations of analyzed species by altering the hydrologic regime of occupied or potential habitat. Loss of individuals or populations could occur through site inundation or desiccation that results from water diversions and developments, whether at the watershed scale, or at the scale of a culvert placement.

Wildlife Populations and Movements: High densities of deer and elk in the analysis area contribute to the grazing pressures plants experience. As both wild and domestic animals graze the palatable forage, the unpalatable species are likely to increase. This effectively reduces diversity of desirable native plant species. The problem is exacerbated because many of these native and non-native "increaser" species are allelopathic.

The actions and effects described above can be both additive and interactive to each other and to the direct and indirect effects described above. The cumulative effects are not expected to contribute to an increase in any current or predicted downward trend in population numbers or density or to current or predicted downward trends in habitat capability that would reduce the existing distribution of the analyzed species.

F. Effects of Alternative B to Sensitive Plant Species

Alternative B would place a 3% cap on disturbance in the PPH areas. PPH accounts for approximately 13% of the project area. PPH areas are predominantly forb and grass meadows (81%) and upland shrub communities (13%). Outside the PPH, activities would continue under current management.

Direct Effects to All Terrestrial & Wetland Species

These caps would reduce, but not eliminate the potential direct effects described in Alternative A. These reductions could benefit individuals and populations of species that occur in meadow or shrublands habitats, but would not likely affect any species as a whole. Species in other habitats would likely experience direct effects in these areas would be as described for Alternative A.

Indirect Effects to All Species

These caps would reduce, but not eliminate the potential indirect effects described in Alternative A. These reductions could benefit individuals and populations of species that occur in meadow or shrublands habitats, but would not likely affect any species as a whole. Species in other habitats would likely experience direct effects in these areas would be as described for Alternative A.

Cumulative Effects to All Plant Species Evaluated

Cumulative effects for Alternative 2 would be similar to those described for Alternative A. However, because this alternative places a 3% cap on new disturbance within the PPH the magnitude of cumulative impacts could be less than described for Alternative A.

G. Effects of Alternative C to Sensitive Plant Species

This alternative would place a 3% cap on disturbance in the PPH and the PGH (the entire 12,500 acre project area). Predominant habitat types are forb/grass meadows (79%), aspen (10%), and wetland shrub communities. Total closure to grazing would further reduce disturbance in the forb/grass meadows.

Direct Effects to All Species

Direct effects to all species in the project area would likely be reduced due to the closure of all livestock grazing, the limitations on road construction, the prohibitions on new fluid mineral leases and wind and solar installations. Excluding these disturbances would have beneficial direct effects for all species in this analysis.

Indirect Effects to All Species

Removal of domestic livestock may result in different species composition of current plant communities. Cessation of livestock grazing in moist meadows can allow succession towards more mesic/hydric communities that favor native species (Green & Kauffman, 1995; Martin & Chambers 2001; Kluse & Allen-Diaz 2005). While removal of livestock can be associated with decreased species richness and diversity, however, the decrease occurs primarily through reduction of grazing-tolerant, non-native species such as Kentucky bluegrass (*Poa pratensis)* (Kluse & Allen-Diaz 2005; Martin & Chambers 2001), timothy grass (*Phleum pretense*) and dandelion (*Taraxacum officinale*) (Green & Kaufman 1995).

If the proposed activities increase palatable forage, rare species may be impacted by wild and/or domestic ungulates as they graze in or travel to the corridor or increase utilization in rare plant habitat. If the proposed activities increase unpalatable species within the analysis area, such as bracken fern, selective herbivory will likely place greater pressure on other plant communities (Randall and Walters 2011) and may include those occupied by rare species.

Removal of domestic livestock may increase forage available to wildlife. This may increase wildlife numbers and, if increased forage availability increases wildlife populations, negative effects of grazing and trampling effects may return to levels previously experienced under domestic grazing. These indirect effects could cancel beneficial direct effects previously described.

Cumulative Effects to All Plant Species Evaluated

Cumulative effects for Alternative C would be similar to those described for Alternative A and B. Because this alternative limits the amount of disturbance the magnitude of cumulative impacts could be less those for either Alternative A or Alternative B.

H. Effects of Alternative D to Sensitive Plant Species

Direct Effects to All Terrestrial & Wetland Species

These caps would reduce, but not eliminate the potential direct effects described in Alternatives A and B. These reductions could benefit individuals and populations of species that occur in meadow or shrublands habitats, but would not likely affect any species as a whole. Species in other habitats would likely experience direct effects in these areas would be as described for Alternative A and B.

Indirect Effects to All Species

These caps would reduce, but not eliminate the potential indirect effects described in Alternative A and B. These reductions could benefit individuals and populations of species that occur in meadow or shrublands habitats, but would not likely affect any species as a whole. Species in other habitats would likely experience direct effects in these areas would be as described for Alternative A and B.

Cumulative Effects to All Plant Species Evaluated

Cumulative effects for Alternative D would be similar to those described for Alternative A and B. However, because this alternative places a 3% cap on new disturbance within the PPH the magnitude of cumulative impacts could be less than described for Alternative A and B.

MANAGEMENT INDICATOR SPECIES REPORT

I. INTRODUCTION

The National Forest Management Act (NFMA) directs National Forests to identify Management Indicator Species (MIS). MIS are chosen as a representative of certain habitat conditions important to a variety of other species. MIS are generally presumed to be sensitive to habitat changes. By monitoring and assessing populations of MIS, managers can determine if management actions are affecting other species populations. According to the *Routt National Forest Land and Resource Management Plan* amendment #4 (USDA Forest Service 2007a, USDA Forest Service 2007b), MIS for the RNF include the six terrestrial and aquatic wildlife species listed in Table 6. There are no plant MIS on the RNF.

Table 9. RNF revised MIS list.

Common Name	Scientific name
Golden-crowned kinglet	*Regulus satrapa*
Northern goshawk	*Accipiter gentilis*
Vesper sparrow	*Pooecetes gramineus*
Wilson's warbler	*Wilsonia pusilla*
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*
Brook trout	*Salvelinus fontinalis*

MIS were reviewed to determine which are present and/or have habitat in the analysis area, and to identify those likely to be affected by the implementation of a management decision. Table 7 outlines RNF MIS, their presence in the analysis area, and anticipated effects due to implementation of an action alternative.

Table 10. RNF MIS, presence in the analysis area, and anticipated effects from implementation of an action alternative.

Common name of MIS	Management issue	Species present in ADH on the RNF?	Habitat present in ADH on the RNF?	Summary of anticipated effects from implementation of an action alternative to MIS
Golden-crowned kinglet	Spruce-fir timber management	No	No	No records of the species or habitat within mapped PPH or PGH habitat. Implementation of the alternatives will cause no changes to populations of golden-crowned kinglets or their habitat. Therefore, this species will not be evaluated in more detail.
Northern goshawk	Lodgepole pine timber management	No	No	No records of the species or habitat within mapped PPH or PGH habitat. Implementation of the alternatives would cause no changes to populations of northern goshawk or their habitat. Therefore, this species will not be evaluated in more detail.
Vesper sparrow	Rangeland residual forage	Yes	Yes	There are records of the species within PPH and PGH habitat. The alternatives propose some changes to grazing management in PPH and PGH, so populations of vesper sparrow could be anticipated to respond to changes in grazing management under each of the alternatives. Therefore, this species will be evaluated in more detail within this analysis under each of the alternatives.
Wilson's warbler	Herbivory in riparian areas	No	No	There are no records of the species within the analysis area. It generally breeds in willow thickets of lakeshores, streambanks, and wet meadows, at or just above timberline at higher elevation subalpine meadows. The alternatives propose some changes to grazing management, but it is not anticipated that these actions will affect in more than a negligible way the Wilson's warbler or its habitat. This species will not be evaluated in more detail.
Colorado River cutthroat trout & Brook trout	Aquatic habitat fragmentation & sedimentation of riparian areas & aquatic habitats	Yes /Yes	Yes/Yes	There are records of these species in streams within the analysis area and adjacent to PPH and PGH habitat. In addition, all fish-bearing streams in the analysis area likely contain brook trout. The alternatives propose some changes to grazing management in PPH and PGH, so populations of Colorado River cutthroat trout and brook trout could be anticipated to respond to changes in grazing management under each of the alternatives. Therefore, these species will be evaluated in more detail within this analysis under each of the alternatives.

II. MIS EVALUATIONS

A. Vesper sparrow (*Poocetes gramineus*)

The vesper sparrow was selected as an MIS to represent issues associated with rangeland residual forage. Vesper sparrows are primarily summer residents on the RNF and use grass/forb habitats within or near the Forest for breeding. Refer to the Environmental Assessment for Management Indicator Species Forest Plan Amendment 04 and the associated Decision Notice for more information regarding this species selection as an MIS (USDA Forest Service 2007b).

***Natural History* —** The vesper sparrow breeds in grasslands, open shrublands mixed with grasslands, and open piñon-juniper woodlands. Vesper sparrows have two broods per nesting season with 3-6 eggs/clutch (Kingery 1998). This species seeks a narrow set of habitat conditions within its nesting range (middle to high elevation sagebrush and grassland habitats) and subtle changes in these conditions (reductions in residual grass and forbs) can impact essential nesting habitat components (Kingery 1998). The vesper sparrow is a common summer resident in foothills (and adjacent lowlands) and mountain parks, a fairly common spring and fall migrant in western valleys, foothills, mountain parks and on eastern plains. In migration this sparrow occurs in open riparian and agricultural areas (NDIS 2005). *Breeding Bird Atlas* (Kingery 1998) data show that, in Colorado, the densest populations occur in middle to high elevation sagebrush. The *Atlas* also shows that montane grasslands support high population densities, as do lower-elevation sagebrush grasslands in northwestern Colorado. Sparsely or patchily distributed shrubs with a good grass cover make the best habitat (Kingery, 1998). It is rare in late summer and fall above timberline. There are about 20 winter records in the western valleys of Colorado, mostly in Mesa County, and on the eastern plains near foothills from Larimer County southward. It appears that this species is occasionally present in these areas during the winter (NDIS 2005).

***Population Status, Abundance and Trend* –** Vesper sparrows are primarily summer residents on the RNF and use grass/forb habitats within or near the Forest for breeding. The 2008 report (Blakesley 2008a) concluded that density estimates of Vesper sparrows (VESP) in Sage/Mountain Meadow habitat were slightly lower on the RNF than state wide for 2005-2007, although 90% confidence intervals of the two samples overlapped in two of the 3 years (Table 8, Figure 2). Results from 2009 further support this trend. In 2010, the sample sites were changed. This change places more of an emphasis on sensitive species and was not specifically stratified with the detection of MIS in mind. With limited samples since that time, there haven't been adequate detections to estimate densities of vesper sparrow on the RNF (Tables 9-10). The change in density and data availability are an artifact of the change in sampling technique and are not likely representative of a change in vesper sparrow population status or trends.

***Routt National Forest MIS Monitoring* —** The RNF has an established protocol for monitoring the vesper sparrow as a Management Indicator Species. This protocol is based on point transect sampling and distance analysis. The protocol identifies an approach to compare the Forest trend to trend at the scale of the state of Colorado and evaluate if the rate of change between the two trends is significantly different (Skorkowsky and Dolan, 2005).

A preliminary analysis was conducted in 2005 (Lukacs, 2005). An additional analysis was completed in 2008 (Blakesley 2008a).

Table 11. Estimated densities of VESP in sage/mountain meadow habitat throughout Colorado, 1999-2007, and within the RNF, 2005-2007 (Blakesley 2008a).

	Colorado					RNF Planning Area				
Year	D	LCL	UCL	%CV	n	D	LCL	UCL	%CV	n
1999	16	10	26	30	145					
2000	37	21	64	34	210					
2001	19	13	30	26	172					
2002	21	14	33	26	175					
2003	29	20	43	24	153					
2004	22	16	31	20	179					
2005	40	28	57	21	231	12	4	32	59	26
2006						13	6	29	46	40
2007	47	30	74	28	346	24	12	46	39	59

D = estimated density (birds/km^2); *LCL* and *UCL* = lower and upper 90% confidence limits on *D*; *%CV* = percent coefficient of variation of *D*; *n* = number of observations used to estimate *D*.

Table 12. VESP density for Colorado and the RNF from 2008-2011 (Blakesley and Hanni 2009, Blakesley et al. 2010, White et al. 2011, White et al. 2012).

	State of Colorado						RNF		
Year	D	N	SE	%CV	90% CI (lower)	90% CI (High)	n	D	%CV
2008	0.46	120906	50346	42	55216	264746	7	0.59	48
2009	-	-	-	-	-	-	7	0.5	49
2010	6.18	1,667,129	-	17	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-

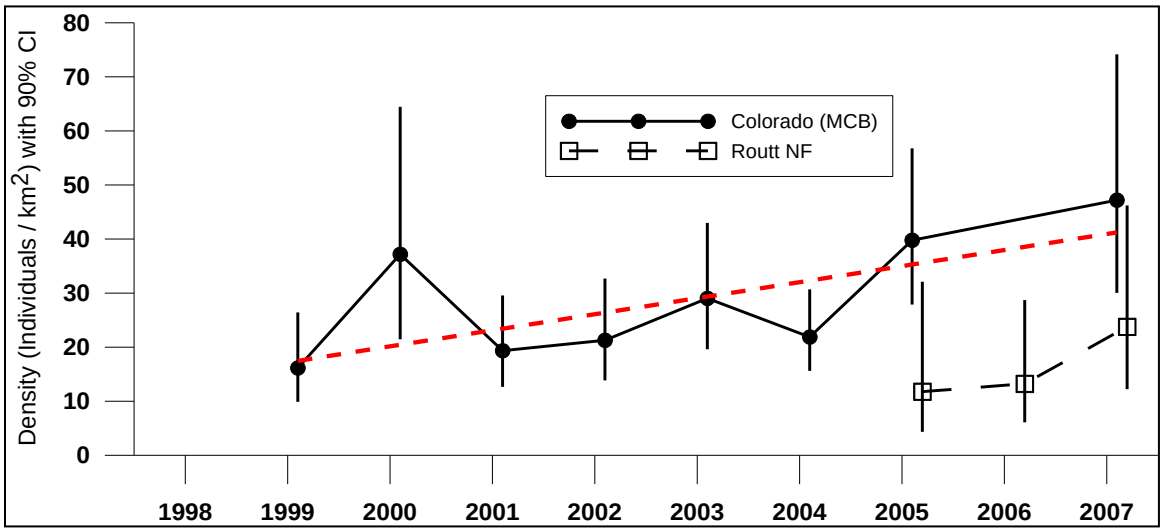

Figure 2. Estimated densities of VESP in sage/mountain meadow habitat throughout Colorado (MCB), 1999-2007, and within the RNF, 2005-2007. Error bars represent 90% confidence intervals. The red (dashed) line represents the best estimate of observed population trend.

Table 13. Vesper sparrow unadjusted counts for the RNF (all cover types) 1998-2011.

Year	Effort (# points sampled)	VESP (# birds observed)	VESP Relative Abundance
1998	75	0	0
1999	195	10	0.051
2000	213	13	0.061
2001	180	7	0.039
2002	210	20	0.095
2003	135	10	0.074
2004	197	22	0.112
2005	560	33	0.059
2006	621	57	0.092
2007	579	84	0.145
2008	239	9	0.038
2009	106	0	0
2010	228	0	0
2011	337	0	0

On the RNF, the vesper sparrow was identified as the MIS species best suited to assist in evaluating this management issue related to rangeland residual forage and the specific question:

- Is adequate residual forage being retained for native species?

Livestock and wild ungulate grazing affects several habitat types, particularly mountain parks and aspen forests. Residual grass and forbs are important as food and cover for many species using rangeland habitats. Species affected include invertebrates, birds, small mammals, as well as several native predators that feed on the birds and small mammals that are associated with these communities. Retaining insufficient residual forage could affect several rangeland-associated species. Monitoring residual forage is an ongoing activity in the management of rangelands and using the vesper sparrow as an MIS compliments the evaluation of whether residual forage direction in the Forest Plan is adequate.

Population trends of this species have historically been relatively stable to slightly increasing, indicating that management approaches implemented on the RNF have been adequate to maintain vesper sparrow populations.

Within the analysis area, the RNF NRIS Wildlife database contains 42 observation records for this species; indicating that suitable habitat exists in the analysis area. All but one of these observations was in the California Park and Slater Park portion of PGH on the Hahns Peak/Bears Ears Ranger District. The other observation was on the edge of the Forest boundary in PPH on the Parks District north of Walden, CO.

Existing habitat conditions for vesper sparrows across the RNF are well-suited to sustain current populations of these birds. During the last 50 years, rangeland management practices have improved grassland conditions on the RNF and vesper sparrow populations have undoubtedly

stabilized as nesting and brood-rearing habitat responded positively to lower livestock numbers. Though numbers may be variable on private lands where human encroachment and habitat alteration/conversion continues, vesper sparrow habitat appears to be improving on National Forest System lands.

Conclusions **—**Available population and habitat information suggests vesper sparrows on the RNF have a population trend that is currently stable. In addition, the vesper sparrow is widely distributed on the Forest and is well-distributed throughout all grassland areas in Colorado. Evidence from the *Colorado Breeding Bird Atlas* (Kingery 1998) surveys across the State suggests vesper sparrow breeding pairs are present in relatively high densities across the landscape, ranking it as the 21st most abundant breeding bird (of 264) in Colorado (Kingery 1998).

Alternative A - No Action

Recreation and Travel

Under this alternative there would be no changes to the current National Forest System Roads, transportation plan, or recreation management on the Forest. That means there would be minimal seasonal restrictions on casual use and some of the areas within GRSG habitat would remain open to cross country travel. In general, the more acres and lineal miles of routes that are designated in an area, the greater the likelihood of habitat fragmentation and disturbance to vesper sparrows. In addition, less restrictive travel conditions usually mean higher concentrations of human use adjacent to motorized routes. This can cause disruption of nesting activities, abandonment of young and temporary displacement. However, since populations have been either stable or increasing in the last few years on the RNF and throughout CO, indications are that the current recreation and travel conditions are not adversely affecting vesper sparrows.

Lands and Realty

Under this alternative, there would be no changes to the current approach associated with exchange, acquisition, or disposal of lands or with permitting ROWs on Forest Service lands. All FS Lands would continue to be managed according to FS policy and regulation. Permitted ROWs would continue to allow construction, maintenance, and operation activities that may result in habitat loss, fragmentation, or degradation for vesper sparrows. Indirect effects may include new infestations of noxious or invasive weeds and an increase in edge habitat. Though most projects would be forced to mitigate or minimize impacts, this alternative would likely have the greatest negative impact on vesper sparrows.

Range

Under this alternative, there would be no change in the numbers, timing, or method of livestock grazing on the Forest. In addition, there would be no change to wild horse or burro management. Potential direct effects to vesper sparrow habitat could include: site specific overgrazing, reduction in cover, structure, and diversity of residual vegetation due to consumption, and degradation of rangeland habitat due to trampling of riparian vegetation. As current livestock grazing management has not caused a decline in vesper sparrow numbers, it is unlikely that the no action alternative would have any adverse effects.

Energy and Minerals

Under this alternative, a small percentage of PPH would be closed to non-energy leasable mineral leasing, with the majority or remainder of all designated habitats open to leasing (including expansion of new leases) with no cap on surface disturbing activities. As such, this alternative would be expected to cause the greatest amount of direct and indirect habitat loss, degradation, and fragmentation for vesper sparrows. There would likely also be greater negative effects from noise, increased presence of roads/humans, and anthropogenic structures in an otherwise open landscape. Recent work from developed natural gas fields in Wyoming gas fields (Gilbert and Chalfoun 2011) documents 10-20 percent declines in the abundance of certain sagebrush obligates (i.e., sage and Brewer‘s sparrow).

Fire and Fuels Management

Alternative A would have the fewest restrictions for fuels management actions and has a high potential for vegetation disturbance. As this alternative does not prioritize fire operations beyond what has already been determined in the Fire Management Plans for the area, potential impacts may include: removing or losing large tracts of habitat due to wildfire, injuring or killing eggs/chicks, causing changes in species movement patterns due to areas being devoid of vegetation, and the increase of non-native or exotic grasses or weeds.

Alternative B – National Technical Team (NTT)

Recreation and Travel

Under this alternative there would be limited opportunities for road construction in PPH, with minimum standards applied and no upgrading of current roads. In addition, recreational use permits would only be given in PPH if there was a neutral or beneficial impact to GRSG and no driving cross country would be permitted in PPH. This is more restrictive than Alternative A, reducing direct and indirect impacts to vesper sparrows by minimizing human use and disturbance and construction or upgrading of roads. This would also likely keep some areas like leks and GRSG nesting habitat less disturbed and fragmented indirectly benefiting the vesper sparrow.

Lands and Realty

Under this alternative, PPH would be managed as an exclusion area and PGH would be managed as an avoidance area for new ROW projects. In addition, Alternative B would encourage consolidation of sage-grouse and therefore most of the known habitat for vesper sparrows on the RNF. These conservation measures would be more protective than conservation measures in Alternatives A and D, but less protective than Alternative C. This represents a concerted effort to maximize connectivity and minimize fragmentation of sagebrush habitats indirectly benefiting the vesper sparrow.

Range

Alternative B would adjust grazing direction in GRSG PPH. This accounts for less than 1% of the land cover of the RNF. The potential effects due to livestock grazing, vegetation disturbance, and range improvements are expected to be the same under Alternative B, as it would be under Alternative A, except that it would provide a few more restrictions to protect vesper sparrow habitat. Not only would that minimize disturbance, but it would provide a very minor positive

effect on the PPH habitat, likely creating small pockets of improved areas for productive breeding, nesting, and brood rearing for vesper sparrow. Though this would occur at a very small scale, effects to local populations would likely be beneficial.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks. Though currently there are no known active leks and very little PPH on the RNF, this alternative would provide protection now and into the future for the most important GRSG habitats, which would encompass the habitats used by vesper sparrow. This alternative may shift energy and mineral development to less desirable sagebrush or non-sagebrush habitats. As the vesper sparrow also prefers grassland areas, by minimizing the effects in sagebrush habitats, other minor negative effects may be observed if development occurs in grassland habitats.

Fire and Fuels Management

Alternative B would be the most restrictive for fire and fuels management actions, but only in PPH. As vesper sparrows are currently found in PGH, effects from this alternative would not largely benefit the species. Effects would be very similar to those described in Alternative A.

Alternative C

Recreation and Travel

Under this alternative, effects would be similar to those mentioned in Alternative B, except that it would apply to ADH and not just PPH.

Lands and Realty

Alternative C would have the most protective measures for vesper sparrows. In this alternative, ADH would be managed as an exclusion area for new ROW projects. In addition, Alternative C would encourage consolidation of sage-grouse habitats, facilitating habitat conservation and habitat contiguity. This alternative would be expected to have the greatest positive impacts to vesper sparrows because of the observations recorded all but one occurred in PGH. This alternative would restrict all ROWs in ADH, thereby protecting every known observation of the species on the RNF.

Range

Under this alternative, all grazing in ADH would be discontinued under this alternative. As overgrazing of livestock is the single largest threat to this species, the removal of domestic livestock grazing would lessen the impacts to vegetation this species uses for nesting and foraging, and it would eliminate the possibility of nest trampling. There would be no known negative effects on vesper sparrows due to alternative C with respect to range resources. Conversely this alternative would likely provide the most positive impacts to vesper sparrows.

Energy and Minerals

Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Fire and Fuels Management

Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Alternative D – Colorado sub-regional

Recreation and Travel

Under this alternative, the effects of most suggested management actions would be similar to Alternative B, with the exception that more flexibility or discretion would be given to the land management agency to allow route construction, road improvements, and issuance of SRPs in PPH if it is determined that these actions would not adversely affect GRSG. Under this alternative if populations and habitats are healthy or improving, it could permit disturbance above the 5% cap of disturbance for the CO management zone. Effects of this alternative could include small continued additive disturbances of vesper sparrow habitat and disruption of normal life history behaviors. As conditions would be monitored for GRSG, the vesper sparrow would likely benefit from the association of sagebrush habitats on the RNF.

Lands and Realty

Under Alternative D, PPH would be managed as an avoidance area, however, new ROW projects would be allowed in designated corridors. ROWs would also be allowed in PPH if the project would not adversely affect sage-grouse populations. This alternative would be more protective than Alternative A, but less protective than Alternatives B and C.

Range

Alternative D would be similar to Alternative B, but would be slightly more restrictive as GRSG habitat objectives within grazing allotments would be applied to ADH and not just PPH. This alternative would have much fewer negative impacts than Alternative A, but slightly more negative impacts than Alternative C. With regard to wild horses and burros, Alternative D would be similar to Alternatives B and C, but would consider all resource values in conjunction with GRSG when managing wild horses and burros. Generally speaking, if GRSG habitat is taken into consideration before applying the management action, then vesper sparrow would likely benefit from that protection or management action.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks similar to Alternative B. However with some mineral development, this alternative would allow up to 5% disturbance in any Colorado Management Zone. Direct effects would be similar to those associated with Alternative B. There may be a few more impacts if the disturbance allowance is increased from 3% to 5%. However the potential for this difference to have negative impacts on vesper sparrow is minor. Therefore effects would be similar to those described under Alternative B.

Fire and Fuels Management

Alternative D is generally the same as Alternative B except that the potential for direct habitat loss and indirect impacts would be greater under this alternative compared with Alternatives B and C due largely to the five percent disturbance cap and allowance for development to occur in

PPH (open for development). As such, this alternative would be expected to provide fewer protective measures to vesper sparrows than Alternatives B and C, but more than Alternative A.

Summary

Effects to the vesper sparrow and its habitat are similar to those described for the Sagebrush Associated Birds (SAB) in the Biological Evaluation. Overall, the highest potential for negative effects would be from Alternative A. Though populations of this species appear to be stable or slightly increasing, additional effects from management actions that might change the structural makeup of the vegetation could have minor detrimental effects. However, the species appears to be doing well under the current management regime. Alternative C restricts direct and indirect human disturbances on the largest number of acres (17,354 acres or 1.5% of the RNF). In this alternative, grazing would be removed from ADH. Alternatives B and D would also provide greater protections to the habitats used by vesper sparrow, but would allow grazing to occur at lower intensities than currently allowed.

The vesper sparrow was identified as an MIS to assess the adequacy of residual vegetation for other native species. Under Alternatives B, C, and D, adequate residual forage would also be retained for these species. Of course as mentioned above, Alternative C, would be the most conservative approach to maintaining the greatest quantity and quality of forage available.

B. Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus)

The Colorado River cutthroat trout (CRCT) was selected as an MIS to represent issues associated with aquatic habitat fragmentation and sedimentation of riparian areas and aquatic habitats. Refer to the Environmental Assessment for Management Indicator Species Forest Plan Amendment 04 and the associated Decision Notice for more information regarding this species selection as an MIS (USDA Forest Service 2007).

CRCT has already been analyzed in the project Biological Evaluation – fish section. A summary at the end of this section will include CRCT, describing the overall effects and placing in context the alternatives with respect to aquatic habitat fragmentation and sedimentation of riparian areas and aquatic habitats.

C. Brook trout (Salvelinus fontinalis)

The brook trout was selected as an MIS to represent issues associated with aquatic habitat fragmentation and sedimentation of riparian areas and aquatic habitats. Refer to the Environmental Assessment for Management Indicator Species Forest Plan Amendment 04 and the associated Decision Notice for more information regarding this species selection as an MIS (USDA Forest Service 2007).

Natural History **—**Brook trout is now the most widely introduced non-native trout species in the west. Preferred habitat is clear, cool, well-oxygenated creeks, small to medium rivers and lakes. The brook trout is highly adaptable to disturbance, and can tolerate temperatures ranging from 0 °C to 20 °C, but prefer temperatures of 14-16 °C (NatureServe 2006). Spawning takes place in September into October, and their usual life span is approximately four years, however in higher

elevation colder climates they often do not reach reproductive maturity until they are four unless they migrate into larger bodies of water (Page and Burr 1991).

Brook trout are nearly ubiquitous in most RNF watersheds. At the broadest scale, none of the common trout species (brook, brown, or rainbow) are native to Region 2. However, these desired non-native game fish have been stocked repeatedly for more than 100 years throughout most of the Rocky Mountain Region. They are now widely distributed, commonly captured and generally abundant in the Rocky Mountain Region as a whole. These fish occur in both stocked and wild (naturally reproducing) populations, although the distribution of species varies locally by habitat type and elevation as a result of minor ecological differences. Brook trout are capable of living under a wide variety of conditions from high to low elevation, often at very high densities.

The primary threats to brook trout populations are negative factors that lower survival of large juveniles and small adults (NatureServe 2006). Introduced brook trout have contributed to the decline of native fishes, amphibians, and invertebrates. In areas identified for Colorado River cutthroat trout restoration, brook trout are targeted for eradication. Methods such as depletion-removal electrofishing have significantly reduced populations and recruitment, but did not totally eradicate brook trout (NatureServe 2006).

Population Status, Abundance and Trend – Several sources of information are available and are useful for estimating current population trend and abundance for brook trout. The data used for brook trout is from various sources which include Division of Wildlife (DOW) stocking reports and survey data from within the analysis area. While none of these data are independently adequate to estimate brook trout population trend and abundance, and some information may even be contradictory, collectively the information affords a basis for making credible inferences about population trend and abundance for brook trout.

Globally and nationally, the conservation status is G5 ~ Secure and N5 ~ Secure, respectively (NatureServe 2006). NatureServe (2006) does not have a conservation status rank for Colorado, because it is not a suitable target for conservation activities. Within the state of Colorado, the brook trout is a game species and can be harvested (CDOW 2007). The daily bag limit is 4 and possession limit is up to 8. In addition to the 4 bag/8 possession limit, brook trout that are 8 inches or less, the daily bag and possession limit is 10 brook trout. The brook trout was first introduced into Colorado in the late 1800's (CDOW 2006). In the early 1900's, state and federal hatcheries began stocking brook trout in great numbers. The numbers peaked in 1930, when 15.4 million brook trout were stocked into Colorado streams and lakes. Most streams in Colorado have a self-sustaining population of wild brook trout that likely are descendants of the 19th Century pioneers.

At a broad scale, brook trout are found to be abundant across the streams of the RNF. For the preparation of the Forest Plan Revision (1998), a GIS analysis was completed for presence of trout species. Approximately 606 miles of stream were analyzed for the presence of brook, brown, cutthroat, or rainbow trout species. Out of the 606 miles of streams analyzed, approximately 439 miles of stream had brook trout present (USDA Forest Service 1996). Through this analysis it was estimated that 72% of the streams on the RNF have the presence of brook trout, but this percentage is likely higher with so few streams having only Colorado River cutthroat, brown, or rainbow trout present.

Collectively, available population and habitat information suggests brook trout on the RNF have a population trend that is stable or likely increasing. Except for streams that are designated as Colorado River cutthroat trout 'conservation populations', the brook trout is widely distributed across the Forest and is well-distributed in mountain streams, ponds, and lakes. The Natural Diversity Information Source (NDIS 2007) categorizes this cold water game fish in Colorado streams as extremely prolific with up to 3,500 brook trout per acre which also suggests stability and likely increasing populations.

Routt National Forest MIS Monitoring — Two rotations of monitoring for this species have been conducted in recent years. Those data have not been analyzed. Brook trout would be expected to occur in streams in all of the designated habitat in the analysis area except for the small pieces of PGH near Carter Mountain and North Ryder Peak. These two areas are too dry to hold suitable streams.

Alternative A - No Action

Recreation and Travel

Under this alternative there would be no changes to the current National Forest System Roads, transportation plan, or recreation management on the Forest. That means that the fewest acres would have seasonal restrictions on casual use and some of the areas within GRSG habitat would remain open to cross country travel. Motorized travel would continue to contribute to minor degradation of aquatic habitat. The condition of fish populations and aquatic habitats across designated habitat would remain stable, reflecting the effects of all past and current management activities. The cumulative effects from existing activities would generally result in maintaining the current conditions of aquatic habitats.

Lands and Realty

Under this alternative, there would be no changes to the current approach associated with exchange, acquisition, or disposal of lands or with permitting ROWs on Forest Service lands. All FS Lands would continue to be managed according to FS policy and regulation. Permitted ROWs would continue to allow construction, maintenance, and operation activities that may result in temporary increases in road use and potential sedimentation. Indirect effects may include new infestations of noxious or invasive weeds that could change the soil stability of the site, making it more likely to erode over time and end up in streams and waterways. These effects would be negligible, especially in light of other conservation measures within the LRMP that would be employed to protect aquatic species.

Range

Under this alternative, there would be no change in the numbers, timing, or method of livestock grazing on the Forest. In addition, there would be no change to wild horse or burro management. The negative effects of livestock grazing could include: trampling and consumption of riparian plants that shade streams, increased sediment loads from overgrazed eroding hill slopes, unstable stream banks due to hoof action, and decreases in water quality and turbidity. This may degrade the conditions for fish making them less suitable. Under this alternative, there would be no change in management action and currently the populations of fish are stable, so they would likely remain the same.

Energy and Minerals

Under this alternative, a small percentage of PPH would be closed to non-energy leasable mineral leasing, with the majority or remainder of ADH open to leasing (including expansion of new leases) with no cap on surface disturbing activities. As such, this alternative would have the greatest potential for damage to riparian and fish habitat. Though there are conservation measures and best management practices in place to minimize effects, continued development would not likely improve conditions for fish species.

Fire and Fuels Management

Alternative A would have the fewest restrictions for fuels management actions and has a high potential for vegetation disturbance. As this alternative does not prioritize fire operations beyond what has already been determined in the Fire Management Plans for the area, potential impacts may include: large burns devoid of vegetation, invasion of exotic grasses or other weeds, and potential decrease in soil stability leading to sedimentation in streams.

Alternative B – National Technical Team (NTT)

Recreation and Travel

Under this alternative there would be limited opportunities for road construction in PPH, with minimum standards applied and no upgrading of current roads. In addition, recreational use permits would only be given in PPH if there was a neutral or beneficial impact to GRSG and driving cross country would not be permitted in PPH. This is more restrictive than Alternative A, providing small beneficial impacts to fish by minimizing human use and maintaining the footprint of existing roads. As only 1% of the RNF is considered PPH, the effects would likely be minor to negligible, but any management direction leading to conservation would be a positive effect.

Lands and Realty

Under this alternative, PPH would be managed as an exclusion area and general habitat would be managed as an avoidance area for new rights-of-way projects. In addition, Alternative B would encourage consolidation of GRSG habitat, facilitating habitat conservation and continuity. These conservation measures would be more protective than conservation measures in Alternatives A and D, but less protective than Alternative C.

Range

The NTT alternative would adjust grazing direction in GRSG PPH. This accounts for less than 1% of the land cover of the RNF and only includes a very small proportion of the southern site in the analysis area where CRCT are known to occur. Mountain sucker are not found in the PPH on the RNF. Even in the area where CRCT do occur, there would be no direct effects to the species from alternative B. The indirect effects from decreasing grazing pressure on such a small part of the RNF could lead to habitat improvements for populations of CRCT further downstream by decreasing the amount of sediment deposited in waterways; however, these improvements would likely be so small as to not be measurable.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks. Though currently there are no known active leks and very little PPH on the RNF, this alternative would provide protection now and into the future for GRSG habitats. There would likely be very minor indirect benefits to fish from protecting PPH.

Fire and Fuels Management

Alternative B would be the most restrictive for fire and fuels management actions, but only in PPH. Again, as there is very little PPH, effects would be similar to those described in Alternative A.

Alternative C

Recreation and Travel

Under this alternative, effects would be similar to those mentioned in Alternative B, except that it would apply to ADH and not just PPH.

Lands and Realty

Alternative C would have the most protective measures for all sage-grouse habitat. In this alternative, ADH would be managed as an exclusion area for new ROW projects. In addition, Alternative C would encourage consolidation of sage-grouse habitats, facilitating habitat contiguity. Maintaining continuous diverse sagebrush habitats would likely maintain good watershed and runoff patterns that sustain health of the land and the streams that bear fish.

Range

The positive effects of Alternative C on fish, would be even more pronounced than those described in Alternative B, because all grazing would be terminated on ADH. Though this only accounts for 1.5% of the land cover of the RNF, effects to fish downstream of these areas could be ameliorated by no cattle grazing in, near, and around riparian areas and streams. There would likely be no negative effects to fish by removing cattle from the system, but substantial positive benefits of reduced sedimentation and turbidity, as well as overall riparian vegetative health and water quality.

Energy and Minerals

Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Fire and Fuels Management

Under this alternative, effects would be similar to those described under Alternative B, except that the same protections would be expanded to include ADH.

Alternative D – Colorado sub-regional

Recreation and Travel

Under this alternative, the effects of most suggested management actions would be similar to Alternative B, with the exception that more flexibility or discretion would be given to the land management agency to allow route construction in PPH, road improvements, and issuance of SRPs if it is determined that these actions would not adversely affect GRSG. This alternative is still more restrictive than Alternative A, and it would likely provide some minor beneficial effects over time.

Lands and Realty

Under Alternative D, PPH would be managed as an avoidance area; however, new ROW projects would be allowed in designated corridors. ROWs would also be allowed in PPH if the project does not adversely affect GRSG populations. This alternative would be more protective than Alternative A, but less protective than Alternatives B and C for fish. Due to the amount of habitat on RNF the effects would be similar to Alternatives B and C.

Range

Alternative D would be similar to Alternative B, but would be slightly more restrictive as GRSG habitat objectives within grazing allotments would be applied to ADH and not just PPH. This alternative would have fewer impacts than Alternative A but greater impacts than Alternative C. With regard to wild horses and burros, Alternative D would be similar to Alternatives B and C, but would consider all resource values in conjunction with GRSG when managing wild horses and burros. Generally, if conservation efforts are made to maintain or improve GRSG habitat before applying the management action, then fish would likely benefit, even in small measure, from that protection or management action.

Energy and Minerals

Under this alternative, PPH would be closed to new fluid mineral leases and existing leases would have a 4 mile no surface occupancy buffer around leks similar to Alternative B. However with some mineral development, this alternative would allow up to 5% disturbance in any Colorado Management Zone. Direct effects would be similar to those associated with Alternative B. There may be a few more impacts if the disturbance allowance is increased from 3% to 5%. However the potential for this difference to have negative impacts on fish is negligible. Therefore effects would be similar to those described under Alternative B, mostly positive.

Fire and Fuels Management

Effects due to Alternative D are generally the same as Alternative B except that the potential for direct habitat loss and indirect impacts would be slightly greater under this alternative compared with Alternatives B and C due largely to the five percent disturbance cap and allowance for development to occur in PPH. As such, this alternative would be expected to provide fewer protective measures to fish than Alternatives B and C, but more than Alternative A.

Summary

Currently, under the no action alternative, population levels and habitat conditions for brook trout and CRCT appear to be stable, even with the current grazing practices. However, under

each of the other three alternatives (B, C, D), the suggested management actions to be taken would further minimize negative impacts and promote more intact and higher quality sagebrush ecosystems on the RNF. Alternative C, is the most conservative and restricts direct and indirect anthropogenic impacts to brook trout and CRCT on the largest number of acres. Under Alternative C, grazing would be terminated in ADH (17,354 acres or 1.5% of the RNF). The removal of domestic livestock grazing would lessen the impacts to streams and riparian areas, eliminate the possibility of trampling fish eggs (by domestic livestock), and would improve overall fish habitat and water quality. Despite the fact that under the current grazing conditions populations appear to be stable, all of the action alternatives would reduce current impacts to brook trout and CRCT beyond management under current management.

As the CRCT and brook trout were selected as an MIS to represent issues associated with aquatic habitat fragmentation and sedimentation of riparian areas and aquatic habitats, it is apparent that the action alternatives would likely improve or stabilize the aforementioned conditions on a localized site-specific scale, commensurate with the 1.5% of designated GRSG habitat on the RNF, better than the No Action Alternative alone. Alternative C would likely have the longest term overall beneficial effects due to the removal of livestock, but each of the action alternatives would likely improve aquatic and riparian habitats by minimizing ROWs, energy development, and road upgrading or construction.

III. CONCLUSION

Golden-crowned kinglet, northern goshawk, and Wilson's warbler, three species of MIS on the RNF were reviewed and not considered in a detailed analysis, because there would be no impact to these species from any of the proposed action due to the different habitat type and areas these species use. The remaining three MIS, the vesper sparrow and both of the aquatic MIS (Colorado River cutthroat trout and brook trout) have been documented in the analysis area and could potentially be affected by an action alternative. When considering the potential for population-level impacts on these species across the planning area of the entire RNF, it is important to consider that the analysis area makes up less than 1% (12,501 acres) of the entire acreage of the Forest. Therefore it is unlikely that any population-level trends at the Forest scale would be significantly altered by any of the action alternatives. A more likely scenario under the action alternatives is that there could be slight increases in the numbers of individuals and quality of habitat in localized areas of designated habitat. This analysis indicates that implementation of any of the action alternatives would maintain at least stable populations and habitat of all species of MIS or not add to the potential for negative impacts.

IV. CONTACTS

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V. LITERATURE CITED

Adams, P.W. and H.A. Froehlich. 1981. Compaction of Forest Soils. Pacific Northwest Extension Publication PNW 217, Oregon, Washington and Idaho Extension Service. Corvallis, OR. 13 pp.

Anderson, D.G. 2006a. Eriogonum exilifolium Reveal (dropleaf buckwheat): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/eriogonumexilifolium.pdf [Jan. 13, 2013]

Andrews, R., and R. Righter, 1992 Colorado Birds. Denver Museum of Natural History, Denver CO. 442 pp.

Andrle, R.F., and J.R. Carroll, eds. 1988. The atlas of breeding birds in New York State. Cornell Univ. Press, Ithaca, NY. 551 pp.

Baker, B.W. 2004. Interaction of beaver and elk herbivory reduces standing crop of willow. In press. Ecological Applications.

Baxter, G.T. and M.D. Stone. 1995. Fishes of Wyoming. Wyoming Game and Fish Department, Cheyenne, Wyoming. 290 pages.

Beatty, B.L., W.F. Jennings, and R.C. Rawlinson, 2003a. Botrychium ascendens W.H. Wagner (trianglelobe moonwort), B. crenulatum W.H. Wagner (scalloped moonwort), and B. lineare W.0H. Wagner (narrowleaf grapefern): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf [Feb 27, 2007].

Beatty, B.L., W.F. Jennings, and R.C. Rawlinson. 2003b. Mimulus gemmiparus (Rocky Mountain monkeyflower): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mimulus gemmiparus.pdf [Jan. 13, 2013].

Beatty, B.L., W.F. Jennings, and R.C.Rawlinson. 2004. Machaeranthera coloradoensis (Colorado tansyaster): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/machaerantheracoloradensis.pdf [Jan. 13, 2013].

Belica, L.T. and N.P. Nibbelink. (2006, August 23). Mountain Sucker (Catostomus platyrhynchus): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/mountainsucker.pdf

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.

Behnke, R. J., and M. Zarn. 1976. Biology and management of threatened and endangered western trouts. USDA Forest Service, Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado. General Technical Report RM-28.

Bergelson, J. and M Crawley. 1992. Herbivory and Ipomopsis aggregata: the disadvantages of being eaten. Am. Nat. 139:870-872.

Blakesley, J.A.., 2008a. Population densities and trend detection of avian Management Indicator Species on the Routt National Forest. Supplemental Report M-MCB-USFS07-01. Rocky Mountain Bird Observatory, Brighton, CO. 11 pp.

Blakesley, J.A.., 2008b. Population densities and trend detection of avian Management Indicator Species on the Medicine Bow National Forest. Supplemental Report M-MWB-USFS07-01. Rocky Mountain Bird Observatory, Brighton, CO. 8 pp.

Blakesley, J.A., and D. J. Hanni. 2009. Monitoring Colorado's Birds, 2008. Tech. Rep. M-MCB08-01. Rocky Mountain Bird Observatory, Brighton, CO. 39 pp.

Blakesley, J. A., D. C. Pavlacky, Jr., and D. J. Hanni. 2010. Monitoring the birds of the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16), 2009 field season report. Tech. Rep. SC-RMR-USFS09-01. Rocky Mountain Bird Observatory, Brighton, CO, 40 pp.

Bock, C. E. and J. H. Bock. 1987. Avian habitat occupancy following fire in a Montana shrubsteppe. Prairie Naturalist 19:153-158.

Braun, C. E., M. F. Baker, R. L. Eng, J. S. Gashwiler, and M. H. Schroeder. 1976. Conservation committee report on effects of sagebrush communities on the associated avifauna. Wilson Bulletin 88:165-171.

Brewer, R., G.A. McPeek, and R.J. Adams, Jr. 1991. The atlas of breeding birds of Michigan. Michigan State Univ. Press, East Lansing, MI. 594 pp.

Campbell, J.B. 1970. Life history of Bufo boreas boreas in the Colorado Front Range. Ph.D. Dissertation, University of Colorado, Boulder, CO.

CDOW (Colorado Division of Wildlife). 2006. Pioneer Brookies. Colorado Division of Wildlife Outdoor Journal. http://wildlife.state.co.us/NewsMedia/OutdoorsJournal/PioneerBrookies.htm

CDOW (Colorado Division of Wildlife). 2007. 2007 Colorado Fishing: Fishing Regulations and Property Directory Brochure. Located at CDOW offices or at website: http://wildlife.state.co.us/NR/rdonlyres/6DE0299B-B621-4248-B56A-00DFF8A66BB3/0/07fishingbrochure.pdf

Chadde, S. and G. Kudray. 2003. Conservation Assessment Botrychium rugulosum (Ternate grapefern). USDA Forest Service R9.

Cochran, P.H. and T. Brock. 1985. Soil Compaction and Initial Height Growth of Planted Ponderosa Pine. PNW-RN-434 USDA Forest Service Pacific Northwest Research Station. Portland, OR.

Conant, R. and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. Third edition. Houghton Mifflin Company, Boston, MA. 450 pp.

Connelly, J.W. and C. E. Braun. 1997. Long-term changes in Sage-grouse Centrocercus urophasianus populations in western North America. Wildl. Biol. 3: 229–234.

CRCT Coordination Team. 2006. Conservation strategy for Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus) in the states of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins. 24p.

Daddow, R.L. and G.E. Warrington. 1983. Growth-limiting soil bulk densities as influenced by soil texture. WSDG Report WSDG-TN-0005, January 1983. Watershed Systems Development Group, USDA Forest Service, Fort Collins, CO.

Decker, K. 2006a. Salix candida Flueggé ex Wild. (sageleaf willow): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/salixcandida.pdf [Jan. 13, 2013].

Decker, K. 2006b. Salix serissima (Bailey) Fern. (autumn willow): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/salixserissima.pdf [Jan. 13, 2013].

Decker, K., D.R. Culver, and D.G. Anderson. 2006. Eriophorum gracile W. D. J. Koch (slender cottongrass): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: Available: http://www.fs.fed.us/r2/projects/scp/assessments/eriophorumgracile.pdf [Jan. 13, 2013].

DiTomaso, J.M. and E.A. Healy 2007. Weeds of California and other western states, Vol.1 University of California, Oakland.

Fausch, K.D. 1988. Tests of competition between native and introduced salmonids in streams: what have we learned? Canadian Journal of Fisheries and Aquatic Sciences 45:2238-2246.

Furness, N.H., B.A. Adomas, Q. Dai, S. Li, and M. Upadhyaya 2008. Alleleopathic influence of houndstongue and its modification by UV-B radiation. Weed Technology 22(1): 101-107.

Freeman, R.S., A.K. Brody, and C.D. Neefus. 2003. Flowering phenology and compensation for herbivory in Ipomopsis aggregata. Oecologia 136:394-401.

Frost, RA., L.M. Wilson, K.L. Launchbaugh, and E.M. Hovde. 2008. Seasonal change in forage value of rangeland weeds in northern Idaho. Invasive Plant Science and Management 1(4):343-351.

Gage, E. and D.J. Cooper. 2006a. Carex diandra Schrank (lesser panicled sedge): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/carexdiandra.pdf [Jan 13, 2013].

Green, D.M. and J.B. Kauffman. 1995. Succession and livestock grazing in a northeastern Oregon riparian ecosystem. J. Range. Manage. 48:307-313.

Hallock, D. 1984. Status and avifauna of willow carrs in Boulder County. C.F.O. Jmml 18: 100

Helms, J.A., C. Hipkin and E.B. Alexander. 1986. Effects of Soil Compaction on Height Growth of California Ponderosa Pine Plantation. WJAF 1(4)1986.

Heidel, B. and J. Handley. 2006. Selaginella selaginoides (L.) Beauv. ex Mart. & Schrank (club spikemoss): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/selaginellaselaginoides.pdf [Jan. 15, 2013].

Hirsch, C.L., S.E. Albeke, and T.P. Nesler. 2006. Range-wide status of Colorado River Cutthroat Trout (Oncorhynchus clarkii pleuriticus) 2005.

Hoffman, R.W. and A.E. Thomas. (2007, August 17). Columbian Sharp-tailed Grouse (Tympanuchus phasianellus columbianus): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/columbiansharptailedgrouse.pdf [Accessed December 21, 2012].

Holmes, J.A. and M.J. Johnson (2005, January 13). Brewer's Sparrow (Spizella breweri): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/brewerssparrow.pdf [Accessed December 21, 2012].

Hornbeck, J.H., C Hull Seig and D.J. Reyher. 2003. Conservation Assessment for great-spurred violet in the Black Hills, South Dakota and Wyoming. Custer, SD: U.S. Department of Agriculture, Forest Service, Rocky Mountain Region, Black Hills National Forest. 29 p.

Keinath, D. and M. McGee. (2005 May 25). Boreal Toad (Bufo boreas boreas): a technical conservation assessment. USDA Forest Service., Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/borealtoad.pdf

Kingery. H. (ed.).1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership. Co-published by the Colorado Division of Wildlife Resources, 636 pages.

Kluse, J.S. and B.H. Allen-Diaz. 2005. Importance of soil moisture and its interaction with competition and clipping for two montane meadow grasses. Plant Ecology 176:87-99.

Knick, S.T., and J.T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe landscapes and breeding passerine birds. Conservation Biology 9:1059-1071.

Ladyman, J.A.R. 2004. Ipomopsis agrreagata (Pursh) V. Grant ssp. weberi V. Grant and Wilken (scarlet gilia):: a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/ipomopsisaggregatasspweberi.pdf [Feb 27, 2012].

Ladyman, J.A.R. 2006a. Astragalus leptaleus Gray (park milkvetch): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region.

Available: http://www.fs.fed.us/r2/projects/scp/assessments/astragalusleptaleus.pdf [Jan 14, 2013].

Ladyman, J.A.R. 2006b. Rubus arcticus L. ssp. acaulis (Michaux) Focke (dwarf raspberry): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region.

Ladyman, J.A.R. 2007. Triteleia grandiflora Lindley (largeflower triteleia): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/triteleiagrandiflora.pdf [Jan. 15, 2013].

Lambeth, R. 1998. Sage sparrow Amphispiza belli. Pages 466-467 in Colorado Breeding Bird Atlas. H. Kingery, editor. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver, Colorado. USA.

Laughlin, S.B., and D.R. Kibbe, eds. 1985. Atlas of breeding birds of Vermont. Univ. Press of New England, Hanover, NH. 456 pp.

Loeffler, C., editor. 2001. Boreal toad conservation plan and agreement. Boreal Toad Recovery Team. http://wildlife.state.co.us/NR/rdonlyres/5E48BE99-6ED0-4A7A-9799-7AC65E2C271E/0/BorealToadRecovery.pdfLukacs, P.M. 2005. Analysis of Avian Management Indicator Species for the Routt National Forest. Medicine Bow-Routt National Forest. Laramie, Wy.

Martin, D.W. and J.C. Chambers. 2001. Effects of water table, clipping, and species interactions on Carex nebraskensis and Poa pratensis in riparian meadows. Wetlands 21: 422-430.

Mergen, D.E. 2006. Cypripedium parviflorum Salisb, lesser yellow lady's slipper: A technical conservation assessment. Technical report prepared for the U.S.D.A.Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/cypripediumparviflorum.pdf [Jan 13, 2013].

Moseley, R.K. 1991. A Field Investigation of Park Milkvetch in Idaho. Idaho Dept. of Fish and Game. Boise, ID.

Morishita, D.W. 1999. Canada thistle. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 162-174.

Mosley J.C., S. Bunting, and M. Manoukian. 1999.Cheatgras. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 175-188.

Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley, CA. 502 pp.

Moyle, P.B. and J.J. Cech, Jr. 2000. Fishes: An introduction to Ichthyology. Fourth edition. Prentice Hall, Upper Saddle River, NJ. 612 pp.

Muller, S. 2000. Assessing occurrence and habitat of Ophioglossum vulgatum L. and other Ophioglossaceae in European forests. Significance for nature conservation. Biodiversity and Conservation 9: 673-681.

Muths, E., S. Rittmann, J. Irwin, D. Keinath, and R. Scherer. (2005 March 24). Wood Frog (Rana sylvatica): a technical conservation assessment. USDA Forest Service. Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/woodfrog.pdf

NatureServe. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 10, 2005).

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: May 3, 2007).

NDIS, 2007. Colorado Species Occurrence and Abundance Tool (Homepage of Colorado Natural Diversity Information Source, Species Occurrence and Abundance Tool, NDIS)), online May 3, 2007 - http://www.ndis.nrel.colostate.edu

NDIS, Colorado Species Occurrence and Abundance Tool (Homepage of Colorado Natural Diversity Information Source, Species Occurrence and Abundance Tool, NDIS)), online 2/8/05 - http://www.ndis.nrel.colostate.edu/wildlife.asp

Neid, S.L. 2006. Utricularia minor L. (lesser bladderwort): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/utriculariaminor.pdf [Jan 15, 2013].

Nellessen, J.E. 2006. Eleocharis elliptica Kunth (elliptic spikerush): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/eleocharis elliptica.pdf [Jan 15, 2013].

Northwest Colorado Greater Sage-Grouse Working Group. 2008. Northwest Colorado Greater Sage-Grouse Conservation Plan. Available On-line [Accessed December 20, 2012]: http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/SpeciesOfConcern/GreaterSageGrouse/ExecutiveSummaryNW.pdf

Olson, Bret E. 1999. Impacts of noxious weeds on ecologic and economic systems. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 4-18.

Page, L.M., and B.M. Burr. 1991. A field guide to freshwater fishes: North America north of Mexico. Houghton Mifflin Company, Boston, Massachusetts. 432pp.

Paige, K.N. 1992. Overcompensation in response to mammalian herbivory: from mutulaistic to antagonistic interactions. Ecology 73:2076-2085

Paige, C., and S. A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush for bird communities. Partners in Flight Western Working Group, Boise, Idaho. 47 pages.

Paige, K.N. and T.G. Whitham. 1987. Overcompensation in response to mammalian herbivory: the advantage to being eaten. Am. Nat. 129: 407-416.

Pruitt, L. 2000. Loggerhead shrike status assessment. U.S. Fish and Wildlife Service. Fort Snelling, MN.

Randall, J.A. and M.B. Walters. 2011. Deer density effects on vegetation in aspen forest understories over site productivity and stand age gradients. Forest Ecology and Management. 261: 408-415.

Righter, R., R. Levad, C. Dexter and K. Potter. 2004. Birds of Western Colorado Plateau and Mesa Country. Page 32. Grand Valley Audubon Society, Grand Junction, CO.

RMBO, Rocky Mountain Bird Observatory, Partners in Flight Species Assessment Database (PIF), online 2/9/05 - http://www.rmbo.org/index.html

Rotenberry, J. T., M. A. Patten, and K. L. Preston. 1999. Brewer's Sparrow (Spizella breweri). A. Poole and F. Gill, editors. The birds of North America, No. 390. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Sage-Grouse National Technical Team. 2011. A Report on National Greater Sage-Grouse

Conservation Measures. Available On-line [Accessed December 18, 2012]: http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/85336_FSPLT2_115747.pdf

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD. Most recent update June 7, 2004, online 2/9/05, http://www.mbr-pwrc.usgs.gov/bbs

Schroeder, M.A., J.R. Young, and C.E. Braun. 1999. Sage-grouse (Centrocercus urophasianus). In The Birds of North America, No. 425 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Schroeder, M. A., and R.K. Baydack. 2001. Predation and the management of prairie grouse. Wildlife Society Bulletin 29:24-32.

Simpson, J.C. and R.L. Wallace. 1982. Fishes of Idaho. University of Idaho Press, Moscow, ID. 238 pp.

Skorkowsky, R. C. and P. Dolan 2005. Draft Medicine Bow – Routt National Forests Songbird Management Indicator Species Monitoring Protocol. Medicine Bow-Routt National Forest. Laramie, Wy.

Slater, G.L. and C. Rock 2005. Northern Harrier (Circus cyaneus): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available On-line [Accessed June 29, 2012]: http://www.fs.fed.us/r2/projects/scp/assessments/northernharrier.pdf

Smith, B.E. and D.A. Keinath. (2007, January 16). Northern Leopard Frog (Rana pipiens): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/northernleopardfrog.pdf [Accessed December 21, 2012].

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

Spackman-Panjabi, S.S. and D.G. Anderson. 2006. Penstemon harringtonii Penland (Harrington's beardtongue): a technical conservation assessment. Unpublished report. USDA Forest Service, Rocky Mountain Region.

Stegelmeier, B.L., D.R. Gardner, L.F. James, and R.J. Molyneux. 1996. Pyrrole detection and the pathologic progression of Cynoglossum officinale (houndstongue) poisoning in horses. Journal of Veterinary Diagnostic Investigation 8(1): 81-90.

Stiver, S.J., A.D. Apa, J.R. Bohne, S.D. Bunnell, P.A. Deibert, S.C. Gardner, M.A. Hilliard, C.W. McCarthy, and M.A. Schroeder. 2006. Greater Sage-Grouse Comprehensive Conservation Strategy. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, WY.

USDA Forest Service. 2012. NRIS Wildlife database. A GIS-based tracking system of Threatened, Endangered, Sensitive Species, or Species of Local Concern.

USDA Forest Service, Routt National Forest GIS data. 1996. GIS coverage of trout streams located on Routt National Forest GIS library used for the preparation of the Routt National Forest Plan Revision.

USDA Forest Service. 1998. Routt National Forest Revised Land and Resource Management Plan. Medicine Bow Routt National Forest. Steamboat Springs, Co. 80487

USDA Forest Service 2007a. Management Indicator Species data located in Medicine Bow-Routt National Forest NRIS Wildlife database. GIS-based application used for administrative purposes.

USDA Forest Service 2007b. Decision Notice and Finding of No Significant Impact for the Management Indicator Species Forest Plan Amendment 04 to the Routt National Forest Land and Resource Management Plan – 1997 Revision, January 2007.

USDA Forest Service. 2003b. Region 2 Sensitive Species Recommendation Rationale: Loggerhead Shrike. http://www.fs.fed.us/r2/projects/scp/evalrationale/rationales/birds/loggerheadshrike.pdf

U.S. Fish and Wildlife Service. 2012. Colorado Field Office County List: Updated January 2012.

U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013.

USDI Fish and Wildlife Service (USFWS). 2010. Endangered and threatened wildlife and plants: 12-month findings for petitions to list the Greater Sage-Grouse (Centrocercus urophasianus) as threatened or endangered. Federal Register 75(55): 13910-14014.

Valentine, J.F. 1990. Grazing management. 2nd Ed. San Diego, CA: Academic Press.

Vizgirdas E. R. 2001. Oct 29. Idaho Moonworts. Unpublished document. USDA Forest Service. Boise National Forest.

White, C. M., N. J. Van Lanen, D.C. Pavlacky Jr., J. A. Blakesley, R. A. Sparks, J.A. Fogg, M. F. McLaren, J.J. Birek, and D. J. Hanni. 2012. Integrated Monitoring of Bird Conservation Regions (IMBCR): 2011 Annual Report. Rocky Mountain Bird Observatory. Brighton, Colorado, USA.

White, C. M., N. J. Van Lanen, D.C. Pavlacky Jr., J. A. Blakesley, R. A. Sparks. J. M. Stenger, J. A. Rehm-Lorber, M. F. McLaren F. Cardone, J. J. Birek and D. J. Hanni. 2011. Integrated Monitoring of Bird Conservation Regions (IMBCR): 2010 Annual Report. Rocky Mountain Bird Observatory. Brighton, Colorado, USA.

Wiggins, D.A. 2005. Loggerhead Shrike (Lanius ludovicianus): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available On-line [Accessed June 29, 2012]: http://www.fs.fed.us/r2/projects/scp/assessments/loggerheadshrike.pdf

Young, M.K. 1995. Colorado River cutthroat trout. Pages 16-23 in M.K. Young, technical editor. Conservation assessment for inland cutthroat trout. USDA Forest Service General Technical Report RM-GTR-256. 61pp.

Wiens, J. A., and J. T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21-41.

Williston, P. 2001. The Ophioglossaceae of Alberta. Alberta Environment, Edmonton, Alberta, CAN. 61p.

With, K.A. 2002. The landscape ecology of invasive spread. Conservation Biology 16(5): 1192-1203.

Zouhar, K. 2002. Cynoglossum officinale. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, March 11].

Zouhar, K. 2003. Linaria spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, March 11].

Zika, P.F., R. Brainerd and B. Newhouse. 1995. Grapeferns and moonworts (Botrychium, Ophioglossaceae) in the Columbia Basin. A report submitted to the Eastside Ecosystem Management Project, U.S. Forest Service Walla Walla, Washington. 126 pages. Available at: http://icbemp.gov/science/scirpt.html.

Zouhar, Kris. 2001a. Centaurea diffusa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available:http://www.fs.fed.us/database/feis/ [2012, February 23].

Zouhar, Kris. 2001b. Centaurea maculosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available:http://www.fs.fed.us/database/feis/ [2012, February 23].

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